DOCUMENT RESUME

ED 282 750		SE 048 174

AUTHOR	Romberg, Thomas A.; And Others
TITLE	1986 Annual Report to the Ford Foundation: The Urban Mathematics Collaborative Project. Program Report 87-4.
INSTITUTION	Wisconsin Center for Education Research, Madison.
SPONS AGENCY	Ford Foundation, New York, N.Y.
REPORT NO	87-4
PUB DATE	Mar 87
NOTE	247p.
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC10 Plus Postage.
DESCRIPTORS	*College Mathematics; College School Cooperation; Cooperative Programs; Higher Education; High Schools; Inner City; Mathematical Enrichment; Mathematics Education; *Mathematics Instruction; *Mathematics Teachers; *Professional Development; *School Business Relationship; Secondary School Mathematics; *Urban Areas
IDENTIFIERS	*Ford Foundation

ABSTRACT

In 1984, the Ford Foundation initiated the Urban Mathematics Collaborative (UMC) project to contribute to the improvement of mathematics education in inner-city schools, and more generally, to enhance the professional life of teachers. By 1986, the Ford Foundation had funded collaboratives in 11 urban areas. This document describes the overall UMC project, as well as the Technical Assistance Project (TAP) designed to serve as a source of information for the collaborative projects. In addition, project descriptions for the collaboratives in Cleveland, Ohio; Durham, North Carolina; Los Angeles, California; Memphis, Tennessee; New Orleans, Louisiana; Philadelphia, Pennsylvania; Pittsburgh, Pennsylvania; St. Louis, Missouri; San Diego, California; San Francisco, California; and the Twin Cities project of Minneapolis-St. Paul, Minnesota, are provided. In each of the cities, the UMC project supports collaboration among groups of mathematicians from high schools, higher education institutions, and industries, and encourages the entry of teachers into a larger mathematics community. The appendices include the summary reports submitted by the 11 mathematics collaboratives and by TAP. (TW)

****
*   Reproductions supplied by EDRS are the best that can be made   *
*   from the original document.   *
****

ED282750

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Deborah M. Stewart
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Program Report 87-4

1986 ANNUAL REPORT TO THE FORD FOUNDATION: THE URBAN MATHEMATICS COLLABORATIVE PROJECT

Thomas A. Romberg, Norman L. Webb,
Allan J. Pitman, and Susan D. Pittelman

A Report from
the Urban Mathematics Collaborative Documentation Project

Wisconsin Center for Education Research
School of Education
University of Wisconsin
Madison, Wisconsin

March, 1987

The work of the Documentation Project was supported by a grant from the Ford Foundation to the Wisconsin Center for Education Research.

Wisconsin Center for Education Research

MISSION STATEMENT

The mission of the Wisconsin Center for Education Research is to improve the quality of American education for all students. Our goal is that future generations achieve the knowledge, tolerance, and complex thinking skills necessary to ensure a productive and enlightened democratic society. We are willing to explore solutions to major educational problems, recognizing that radical change may be necessary to solve these problems.

Our approach is interdisciplinary because the problems of education go far beyond pedagogy. We therefore draw on the knowledge of scholars in psychology, sociology, history, economics, philosophy, and law as well as experts in teacher education, curriculum, and administration to arrive at a deeper understanding of schooling.

Work of the Center clusters in four broad areas:

- Learning and Development focuses on individuals, in particular on their variability in basic learning and development processes.
- Classroom Processes seeks to adapt psychological constructs to the improvement of classroom learning and instruction.
- School Processes focuses on schoolwide issues and variables, seeking to identify administrative and organizational practices that are particularly effective.
- Social Policy is directed toward delineating the conditions affecting the success of social policy, the ends it can most readily achieve, and the constraints it faces.

The Wisconsin Center for Education Research is a noninstructional unit of the University of Wisconsin-Madison School of Education. The Center is supported primarily with funds from the Office of Educational Research and Improvement/Department of Education, the National Science Foundation, and other governmental and nongovernmental sources in the U.S.

TABLE OF CONTENTS

Page
Introduction 1

Project Descriptions 5

Cleveland Collaborative for Mathematics Education (C^{2}ME) 6
Durham Collaborative: The Durham Mathematics Council . 7
Los Angeles Urban Mathematics/Science Collaborative (LAUM/SC) 8
Memphis Urban Mathematics Collaborative 10
New Orleans Mathematics Collaborative (NOMC) 11
Philadelphia Math Science Collaborative 12
Pittsburgh Mathematics Collaborative 13
St. Louis Urban Mathematics Collaborative 15
San Diego Urban Mathematics Collaborative 17
San Francisco Mathematics Collaborative 18
Twin Cities Urban Mathematics Collaborative 20
Technical Assistance Project 21

Observations and Reflections 23

Final Comments 41

References 45

Appendixes: Summary Reports for the Eleven Urban Mathematics Collaboratives and for the Technical Assistance Project 47

A. Cleveland Collaborative for Mathematics Education (C^{2}ME) A-1
B. Durham Collaborative: The Durham Mathematics Council B-1
C. Los Angeles Urban Mathematics/Science Collaborative (LAUM/SC) C-1
D. Memphis Urban Mathematics Collaborative D-1
E. New Orleans Mathematics Collaborative (NOMC) . . . E-1
F. Philadelphia Math Science Collaborative F-1
G. Pittsburgh Mathematics Collaborative G-1
H. St. Louis Urban Mathematics Collaborative H-1
I. San Diego Urban Mathematics Collaborative I-1
J. San Francisco Mathematics Collaborative J-1
K. Twin Cities Urban Mathematics Collaborative . . . K-1
L. Technical Assistance Project (TAP) L-1

I. INTRODUCTION

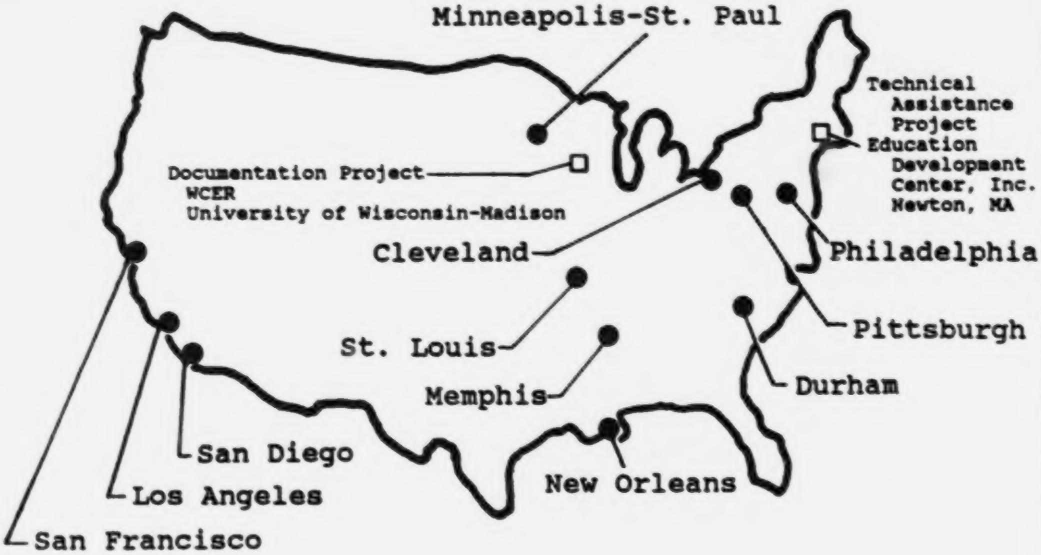
In 1984, the Ford Foundation initiated the Urban Mathematics Collaborative (UMC) project to contribute to the improvement of mathematics education in inner-city schools and, more generally, to enhance the professional life of teachers. Early in 1985, the Ford Foundation established five collaborative projects in urban centers across the United States, a Documentation Project to monitor the activities of the seven collaboratives, and a Technical Assistance Project (TAP) to serve as a source of information for the collaborative projects (Romberg & Pitman, 1985). Later that year, two more collaboratives were started. During 1986, the Ford Foundation funded collaboratives in four additional urban areas, bringing to eleven the total number of urban mathematics collaboratives. (See Figure 1.)

In each of the eleven cities, the UMC project supports collaboration among groups of mathematicians from high schools, higher education institutions, and industries and encourages the entry of teachers into a larger mathematics community. Its activities are meant to address some poignant realities of teaching in inner-city schools as well as the intellectual isolation of most teachers from recent developments in mathematics and its uses. The teacher is the centerpiece of the educational enterprise but--especially in inner-city schools--is likely to be overworked, lacking in support services and material resources, and isolated from other teachers, other professional adults, and changing ideas about mathematics. The urban mathematics collaboratives have assembled local resources--both financial and human--and have configured them in a variety of ways to explore new modes of professionalism for teachers and new kinds of relationships between high school mathematics teachers and the professional users of mathematics in higher education and in business. Considered individually, the collaboratives can be seen as useful local projects. Linked together, they have become a national comprehensive field experiment to develop and test new modes of enhancing teachers' knowledge about mathematics and their professionalism.

It is the intention of the Foundation that, as the collaborative projects develop, they will provide a framework to enhance teachers' professional activities. The Foundation's initial objective was to provide nondirective support that would enable each network to develop its organizational framework and to choose its own focus of interest. As the effort continues, it will focus on the effects of the developing networks on the professional lives of the participating teachers and on the identification of issue-based outcomes. The Foundation's intention in this effort is consonant with the recommendations of the Conference Board of the

THE
URBAN MATHEMATICS COLLABORATIVE PROJECT

Funded by
The Ford Foundation


Minneapolis-St. Paul
Technical Assistance Project
Education Development Center, Inc.
Newton, MA
Documentation Project
WCER
University of Wisconsin-Madison
Cleveland
Philadelphia
St. Louis
Pittsburgh
Memphis
Durham
San Diego
New Orleans
Los Angeles
San Francisco

- **Cleveland Collaborative for Mathematics Education (C^2ME)**
  Cleveland, Ohio
- **Durham Collaborative: The Durham Mathematics Council**
  Durham, North Carolina
- **Los Angeles Urban Mathematics/ Science Collaborative (LAUM/SC)**
  Los Angeles, California
- **Memphis Urban Mathematics Collaborative**
  Memphis, Tennessee
- **New Orleans Mathematics Collaborative (NOMC)**
  New Orleans, Louisiana
- **Philadelphia Math Science Collaborative**
  Philadelphia, Pennsylvania
- **Pittsburgh Mathematics Collaborative**
  Pittsburg, Pennsylvania
- **St. Louis Urban Mathematics Collaborative**
  St. Louis, Missouri
- **San Diego Urban Mathematics Collaborative**
  San Diego, California
- **San Francisco Mathematics Collaborative**
  San Francisco, California
- **Twin Cities Urban Mathematics Collaborative**
  Minneapolis-St. Paul, Minnesota

Figure 1. The Ford Foundation National Network of Urban Mathematics Collaboratives.

Mathematical Sciences (1984):

> The Conference recommends the establishment of a nationwide collection of local teacher support networks to link teachers with their colleagues at every level, and to provide ready access to information about all aspects of school mathematics. (p. 5)

The broad sense in which the term colleague is used is exemplified by the objectives "strongly endorsed by the Conference":

- to extend the sense of professionalism among teachers by building a support system that links them to colleagues in the mathematical sciences, inside and outside of the schools;

- to provide teachers at all levels with colleagues upon whom they can call for information concerning any aspect of school mathematics; and

- to enable teachers to enlarge their views of mathematics, their sources of examples, and their repertoire of classroom skills in communicating mathematics. (CBMS, 1984, p. 15)

It has been the Foundation's aim to assist in the establishment of networks in which mathematics teachers can participate as colleagues with mathematicians in business, government, higher education, and industry. In these networks, mathematics teachers will be participants rather than clients.

The purpose of the Documentation Project is to record the progress of each collaborative in defining, redefining, and refining its focal concerns. The efforts of each project, as well as those of the Ford Foundation itself, need to be studied for three reasons. First, each project and the Ford Foundation need to be kept informed about what is happening. Ongoing activities, the strategies employed, and the effects of those activities on the professional lives of the teachers and other project participants need to be documented. Second, it is important for the projects, the Ford Foundation, and the educational policymaking community to understand the characteristics and relationships inherent within each project. Because changes occur slowly over time, the activities, the actual changes in behavior, the anticipated and unanticipated outcomes, and the impediments encountered under different circumstances need to be identified and studied. Third, although we expect each site to be different, we are confident that from the data it will be possible to identify project activities and strategies which can be generalized to different settings.

On-site data about the collaboratives' activities has been collected from a variety of sources, including:

1. the directors and coordinators of each project;

2. the on-site observers from each project (reflecting the teachers' perspectives);

3. visits by the staff of the Documentation Project;

4. joint meetings with personnel from the Ford Foundation and the Technical Assistance Project personnel;

5. meetings of the project directors;

6. meetings of representatives of all of the projects; and

7. surveys administered to participating teachers.

This report presents an overview of the effort of the UMC project as a whole, as well as a brief description of each of the collaboratives and the Technical Assistance Project. The Appendix of the report includes a detailed progress report for each of the projects for 1986.

II. PROJECT DESCRIPTIONS

A brief description of each of the eleven Urban Mathematics Collaboratives is presented in this section. A description of the Technical Assistance Project follows. (A more detailed report of each collaborative is appended to this paper.)

Cleveland Collaborative for Mathematics Education (C^2ME)

Director: Ms. Paula C. Anderson
Coordinator: Ms. Suzanne Haggerty
On-Site Observer: Mr. Robert Seitz
Funding Agent: The Cleveland Education Fund
Date of Initial Funding: February 1, 1985

The Cleveland Collaborative for Mathematics Education (C^2ME) was one of the five original collaboratives established in 1985. The collaborative, which serves the approximately 200 secondary mathematics teachers in the Cleveland Public Schools, is administered through the Cleveland Education Fund.

The specific goals of the Cleveland Collaborative for Mathematics Education are to improve community perception of the public schools, to provide greater cohesion among teachers, to provide teachers with better resources, and to enhance the quality of mathematics education in the Cleveland Public Schools.

A thirty-two member Advisory Board and an eleven-member Teacher Advisory Board provide input to the collaborative's director and project coordinator. The Advisory Board, which oversees the operation of C^2ME, is comprised of representatives of science, education, and business, including seven mathematics teachers from the Cleveland Public Schools. An eleven-member Teacher Advisory Board was established in early 1986 to assist the collaborative in developing its long-range plans and future activities; teachers were selected to serve on the board based on their pattern of participation in C^2ME's programs and on their dedication to excellence in mathematics education in the Cleveland Public Schools.

During 1986, C^2ME offered a wide variety of activities designed to provide teachers with opportunities for training, information, collegiality, and networking with other teachers, as well as with mathematicians from business, industry, and higher education. The collaborative sponsored a series of dinner symposia, provided access for teachers to attend workshops at Oberlin College, Baldwin Wallace College, and other local colleges, and supported mathematics contests. In addition, the collaborative encouraged participation in the Cleveland Teachers Internship Program and helped to facilitate the awarding of tuition scholarships for higher education, as well as small grants, to teachers in the Cleveland Public Schools. The collaborative has established a multi-purpose Resource Center for mathematics teachers and publishes its own quarterly newsletter, edited by the on-site observer.

Durham Collaborative: The Durham Mathematics Council

Director: Dr. J. Keith Brown
Executive Director: Dr. Jo Ann Lutz
On-Site Observer: Ms. Betty Peck
Funding Agent: The North Carolina School of Science
and Mathematics
Date of Initial Funding: August 1, 1985

The Durham Mathematics Council was established in August, 1985, as the sixth collaborative in the Urban Mathematics Collaborative project. The collaborative, which serves more than 100 secondary mathematics teachers in the Durham city and county school systems, is administered through the North Carolina School of Science and Mathematics.

Since its inception, the project has identified five major areas for involvement to enhance professional growth for secondary school mathematics teachers. They are: enhancement of knowledge about local mathematics applications; expansion of the limited opportunities for teachers to travel; support for teachers' growth as mathematicians; provision of opportunities for professional collegiality; and combating loss of professional self-esteem and "burnout."

The project director and the executive director receive assistance in administering the affairs of the collaborative from the Board of Directors. The fifteen-member Board of Directors is comprised of representatives from area businesses, higher education, and the city and county school districts, including two teachers. The Steering Committee, comprised of one teacher from each school, was established to provide a direct link between the teachers and the collaborative administration.

The programs of the Durham Mathematics Council are designed to encourage junior and senior high school mathematics teachers to communicate with their colleagues in all areas of professional mathematics. Since its establishment, the Council has sponsored seminars, workshops, and corporate-facility tours in North Carolina's Research Triangle Area, using the resources offered by area businesses and universities. In 1986, the Council initiated an industry internship program and supported teacher participation in university study, as well as attendance at professional meetings.

Los Angeles Urban Mathematics/Science Collaborative (LAUM/SC)

Executive Director: Ms. Peggy Funkhouser
Coordinator: Ms. Toby Bornstein
On-Site Observer: Mr. Richard Curci
Funding Agent: Los Angeles Educational Partnership
Date of Initial Funding: February 1, 1985

The Los Angeles Urban Mathematics/Science Collaborative (LAUM/SC) was formed in mid-1986 as a result of a restructuring and reorientation of the Los Angeles Urban Mathematics Collaborative, one of the five original collaboratives. LAUM/SC is the official title of the thirty-five member Advisory Committee to the funding agent, the Los Angeles Educational Partnership. The collaborative is responsible for four programs, one of which is the Ford Foundation-sponsored +PLUS+ (Professional Links with Urban Schools). The Advisory Committee is comprised of lead teachers from +PLUS+, Board of Education members, representatives of the school districts directly involved, the County Office of Education, and representatives of foundations, museums, corporations, professional organizations, and postsecondary institutions. Members of the Board of Directors of the Los Angeles Educational Patnership serve as ex-officio members of the committee.

The collaborative serves not only the entire Los Angeles Unified School District (LAUSD) but several smaller nearby districts as well. Because of the massive potential target population, the collaborative's +PLUS+ program has directed much of its attention to the mathematics departments in three high schools. The departments in these schools have formed teams with business and post-secondary associates. In 1987, five additional schools will be identified to form +PLUS+ teams. Thus, there are two aspects of the +PLUS+ initiative, one directed at the mathematics departments in target schools and the other at the mathematics teachers in forty-seven high schools in the Los Angeles area.

The goal of +PLUS+ is to assist teachers to relate the world of work to the mathematics curriculum and to benefit from expanded mathematical horizons through interaction with colleagues in a mathematics resource network. Within the +PLUS+ program, steering committees plan activities; these committees are comprised of teachers and business and college associates, all of whom are considered members of the +PLUS+ program. The relationship between teachers and the business and college associates is a special one; the +PLUS+ teams in each of the target schools work together to prepare and execute plans for professional development. Considerable effort has been expended on building these teams, with the goal of creating and consolidating departmental cohesion. To this end, a series of dinner meetings was organized by and for the teams, in which invited speakers participated. Departments in target schools agreed to define needs, explore resources, and develop a program of activities as prerequisites for financial support.

The efforts of teachers in the +PLUS+ program during the latter part of 1986 focused on planning a series of four mathematics content workshops for all regional mathematics teachers. Teachers served on planning teams for each workshop topic and in many cases also served as the workshop coordinator. During 1986, the collaborative also initiated a pilot summer internship program and funded attendance of +PLUS+ teachers at several local and national conferences.

Memphis Urban Mathematics Collaborative

Executive Director: Mr. Herman Ewing
Project Director: Ms. Nancy Gates
On-Site Observer: Ms. Rita Ross (appointed January, 1987)
Funding Agent: Memphis Urban League, Inc.
Date of Initial Funding: September 1, 1986

The Memphis Urban Mathematics Collaborative, which was the last collaborative to join the UMC project, serves a potential population of 345 mathematics teachers in the Memphis City Schools. It is administered through the Memphis Urban League, Inc.

The collaborative's goal is to promote professionalism among mathematics teachers and to assist them in broadening their horizons through creative relationships between teachers and other mathematics professionals.

The collaborative is governed by a nineteen-member Advisory Committee comprised of five teachers, five mathematics professors, and representatives from college administration, several business, the school district administration, and the Urban League. At this early stage, further organizational infrastructure is evolving with the establishment in December of a Steering Committee and subgroups responsible for activities.

Collaborative efforts in 1986 focused on the preparation of the funding proposal to the Ford Foundation and initial steps to establish project activities. Subcommittees for a summer internship program and a Speakers Bureau began meeting in November, and teacher information-and-input meetings, held in a number of schools, were attended by sixty-nine teachers.

New Orleans Mathematics Collaborative (NOMC)

Director: Ms. Constance Barkley
Coordinator: Dr. Olympia Boucree
On-Site Observer: Ms. Aldonia Winn
Funding Agent: The Metropolitan Area Committee (MAC) Foundation
Date of Initial Funding: September 1, 1986

The New Orleans Mathematics Collaborative was the tenth collaborative to be funded by the Ford Foundation. The collaborative, which serves the approximately 130 senior high school mathematics teachers in the Orleans Parish Public Schools system, is one of four program coordinated by the Metropolitan Area Committee Education Fund.

The goals of the collaborative are to enhance the professional development of the mathematics teachers and to enrich the teaching of mathematics. These are to be achieved by providing teachers with opportunities to develop networks of mathematicians, to work collaboratively with other teachers and mathematicians, to keep abreast of developments in mathematics and teaching, and to experience mathematics usage outside an academic setting.

The collaborative is governed by a twenty-member Steering Committee of teachers, district administrators, and representatives from the teachers' union, businesses, universities, and the Louisiana Science Centre. The Chair is a member of the MAC Education Fund Board. The collaborative's activities are overseen by four subcommittees: symposia, site visits and internships, workshops, and the newsletter.

The collaborative held a reception at the Louisiana Science Centre on November 18 to officially launch the project. In December, the collaborative sponsored a symposium, "Mathematics for All," which included a presentation on the use of mathematics by a university professor, followed by a panel discussion involving a mathematics teacher and a representative from business.

Philadelphia Math Science Collaborative

Director: Dr. Wayne Ransom
Coordinator: Ms. Sue Stezer
On-Site Observer: Ms. Joyce Neff
Funding Agent: The Franklin Institute
Date of Initial Funding: February 1, 1985

The Philadelphia Math Science Collaborative was formed in fall, 1986, through a restructuring and reorientation of the Philadelphia Mathematics Collaborative, one of the original five collaboratives. The collaborative, which serves mathematics and science teachers in six target high schools in the School District of Philadelphia, is administered through the Franklin Institute.

The purpose of the Philadelphia Math Science Collaborative is to promote teacher leadership and team building and to contribute to a vision of mathematics teaching in the future. Specifically, the collaborative hopes to: (1) develop, evaluate, and document the position of an in-school collaborator who would facilitate communication and serve as a catalyst for change and (2) increase teacher participation in extramural professional development programs which offer partnership between teachers and their colleagues in academia and industry, opportunities to enhance knowledge, skills, and professionalism, and new ideas for mathematics instruction. The collaborative also hopes to develop a model for documenting the impact these two programs will have upon the quality of teachers' professional lives.

The collaborative is governed by an eighteen-member Advisory Council, consisting of one teacher from each of the target schools, as well as representatives from various local colleges, businesses, and organizations. The Advisory Committee meets once every two months to help evaluate and reshape existing programs, as well as to design new programs with an eye toward providing support to the coordinator and direction for the collaborative.

In addition to encouraging teachers to participate in the many programs provided for them by other organizations in the Philadelphia area and providing teachers in the target schools free memberships in their local professional organizations, the collaborative has offered several activities during 1986 aimed specifically at the targeted teachers. These programs include mini-grants which enable teachers to attend professional meetings, workshops, and seminars; monthly departmental meetings, which have included guest speakers and reviews of educational software; a newsletter; a teacher's network for mathematics in applications; and a clearinghouse service which keeps teachers notified of resources for classroom use.

Pittsburgh Mathematics Collaborative

Project Coordinator: Dr. Leslie Salmon-Cox
Associate Project Coordinator: Dr. Martina Jacobs
On-Site Observer: Ms. Rosemarie Kavanagh
Funding Agent: Allegheny Conference on
Community Development
Date of Initial Funding: September 1, 1985

The Pittsburgh Mathematics Collaborative, serving the 126 high school mathematics teachers in the Pittsburgh Public Schools, was the seventh collaborative to be established. The collaborative is administered through the Allegheny Conference Education Fund.

Six goals provide a focus for the collaborative: to overcome teachers' isolation through increased opportunities for interaction; to educate the community about the professional nature of high school mathematics teachers; to enhance teachers' knowledge of mathematics applications; to provide opportunities for professional self-enhancement; to provide opportunities for teacher recognition; and to provide time for teacher interaction, work, and professional development. These goals are envisioned as working toward institutionalization of structures and processes which will foster teacher professionalism and will be decreasingly reliant on external administration and facilitation.

Collaborative governance is shared among the twenty-nine member Steering Committee and its Executive Committee, called the "First Tuesday Committee," and the department chairs from each of the twelve high schools. The Steering Committee, comprised of teachers, school district administrators, college and university faculty members, and representatives from various community councils, corporations, and foundations, meets twice annually to discuss the direction and activities of the collaborative. The department chairs meet monthly to plan and evaluate specific activities. The group of department chairs also serves as the major communication channel between the collaborative and the teachers.

During 1986, the Pittsburgh Mathematics Collaborative offered a wide variety of activities and programs designed to enhance professionalism and collaboration among teachers and professionals in the mathematical sciences, as well as to provide teachers with information about the applications of mathematics. These included receptions, seminars on uses of mathematics in the workplace, computer training, curriculum development involving the use of calculators, and tours of local industries. The collaborative also encouraged teachers to take advantage of professional opportunities provided by related organizations, such as professional conferences, lectures, and professional enrichment grants.

St. Louis Urban Mathematics Collaborative

Director: Ms. Judy Morton
On-Site Observer: Mr. James Richmond (appointed January, 1987)
Funding Agent: Mathematics and Science Education Center
Date of Initial Funding: April 15, 1986

The St. Louis Urban Mathematics Collaborative is one of the four collaboratives established in 1986. The collaborative, which serves the 104 secondary mathematics teachers in the St. Louis Public School District, is administered through the Mathematics and Science Education Center.

The four primary goals of the collaborative focus on giving teachers the opportunity to explore business-, industry-, and university-based resources to determine how these resources may assist them in their professional growth and classroom instruction; develop and implement staff training programs for themselves and for their peers improve communication and information exchange among mathematics teachers both within and across schools; and promote recognition of accomplishments and quality performance among all mathematics teachers and students. These goals were derived from the expectation of secondary mathematics teachers that the collaborative would improve communication, collegiality, knowledge of mathematics and its applications, instructional expertise, and feelings of professionalism among the targeted teachers.

Administrative duties in the collaborative are shared between the sixteen-member Collaborative Council currently being established and a four member team composed of the collaborative director and three district staff members; the director of the Partnership Program, and two mathematics supervisors from the St. Louis Public Schools. The Collaborative Council, when fully staffed, will consist of ten educators from the St. Louis Public Schools, and two representatives from each of the academic, business, and scientific communities. The Council plans to meet twice monthly to discuss, plan, and evaluate collaborative events.

Many of the activities sponsored by the collaborative during 1986 have focused on getting teacher input on and generating interest in programs to be offered in the future. Various planning meetings have been held to make teachers aware of the opportunities for professional growth which could be made available to them. As an initial activity, the collaborative funded teachers to attend a conference designed to increase awareness of linkages between science, mathematics theory and technology. During summer 1986, the collaborative supported teachers to compile resource lists for distribution throughout the district. Resources that were catalogued included people and organizations; data communications, books and journals; videotapes and films; and computer software. The collaborative also organized summer site visits to area busiensses. In December, the collaborative sponsored a grant-writing seminar, at which mathematics teachers were informed about two grant programs that were available to them.

San Diego Urban Mathematics Collaborative

Director: Prof. Alma Marosz
Coordinators: Mr. Frank Holmes
Ms. Beth Schlesinger
On-Site Observer: Dr. Sharon D. Whitehurst
Funding Agent: San Diego State University Foundation
Date of Initial Funding: April 15, 1986

The San Diego Urban Mathematics Collaborative, established in spring, 1986, is administered through the San Diego State University Foundation. The collaborative serves sixty-six mathematics teachers from six targeted schools: a senior high school and its two feeder schools in each of the Sweetwater Union High School District and the San Diego Unified School District.

The primary goal of the collaborative is to improve the professional life of mathematics teachers in the San Diego area by reducing the tendency to work in isolation and by increasing the contacts that foster mutual support, professional growth, and involvement with the larger professional mathematics community.

The collaborative is governed by a project director, two project coordinators, and the Executive Committee consisting of mathematics specialists from the city and county, teachers who were involved in writing the proposal, and teachers from the targeted schools, as well as a faculty member from San Diego State University and the collaborative director and coordinators. The major thrust of the Executive Committee's efforts currently is directed toward instilling in teachers a sense of project ownership.

In addition to encouraging teachers to take advantage of a wide array of local resources, the collaborative has hosted a wine-and-cheese reception, an evening dinner colloquium and social, summer workshops at San Diego State University, a mini-course in discrete mathematics, and a workshop on technology in the classroom. The collaborative has also paid the membership dues in the Greater San Diego Mathematics Council for all the mathematics teachers in the six target schools and offered stipends to forty teachers to attend the fall conference of the Southern Section of the California Math Council.

San Francisco Mathematics Collaborative

Executive Director: Ms. Gladys Thacher
Director of Development & Community
  Outreach: Ms. Janice E. Toohey
Teacher Coordinator: Ms. Wandaline Perelli
On-Site Observer: Ms. Joanne Pamperin
Funding Agent: San Francisco Education Fund
Date of Initial Funding: February 1, 1985

The San Francisco Mathematics Collaborative was one of the five original collaboratives established in 1985. The collaborative, which serves the 105 mathematics teachers in the San Francisco Unified School District who hold a major, minor, or advanced degree in mathematics, is administered through the San Francisco Education Fund.

The purpose of the San Francisco Mathematics Collaborative, is to show teachers "how mathematics is imbedded in the world around us, while being sensitive to the needs and interests of the teachers involved in the program." In light of this purpose, collaborative efforts focus on developing leadership skills in teachers and department heads through seminars and opportunities to attend conferences; building collegiality among teachers and networks between teachers and other mathematics professionals; and enabling teachers to infuse into their instruction a sense of imbeddedness of mathematics in the real world.

The collaborative's Steering Committee and Teacher Advisory Committee provide input to the Project Director. The Steering Committee, comprised of the Executive Director of the San Francisco Education Fund, representatives from the Exploratorium, San Francisco State University, the University of San Francisco, San Francisco Community College, San Francisco Unified School District, and the private sector, as well as several members of the collaborative's Teacher's Council, meets monthly to develop and implement policy, monitor and evaluate activities, and plan future activities. The Teacher's Council currently is being reorganized as a subcommittee of the Steering Committee; it will include six teachers and the teacher coordinator as an ex-officio member. In addition to these three committees, the newly formed Advisory Committee, comprised of the Training Council of the San Francisco Consortium of Higher Education and representatives from the Exploratorium, provide the collaborative with expertise and perspective.

During 1986, the San Francisco Mathematics Collaborative offered a wide variety of activities which enabled teachers to form networks with their peers and with other professionals, and to increase their awareness of the developing world of mathematics and its applications. The Summer Institute at the Exploratorium, as well as follow-up sessions to both the 1985 and 1986 Summer Institutes, exposed teachers to applications of mathematics in the physical sciences. A series of Dinner Lectures brought teachers together with professionals in the mathematical sciences and provided an opportunity for collegiality and for bridging the gap between mathematical theory and application in the worlds of commerce, industry and technology. Mini-grants also were made available to teachers for projects designed to enrich students' mathematics education.

Twin Cities Urban Mathematics Collaborative

Director: Prof. Harvey B. Keynes
Teacher Coordinator: Ms. Sally Sloan
On-Site Observer: Mrs. Gerry Sell
Funding Agent: School of Mathematics, University of Minnesota-Minneapolis
Date of Initial Funding: February 1, 1985

The Twin Cities Urban Mathematics Collaborative was one of the five original collaboratives established in 1985. The collaborative, which serves about 200 mathematics teachers in the Minneapolis and St. Paul school districts, is administered through the School of Mathematics at the University of Minnesota.

Since its inception, the project has directed its efforts at helping teachers to exercise more control over their professional lives; at providing professional and educational opportunities to teachers; at expanding the involvement of business and industry; at integrating its efforts with those of other mathematics education organizations; and at increasing its visibility, especially within the school district.

The collaborative's director receives input from a Steering Committee and a Teacher Advisory Committee. The Steering Committee, which oversees collaborative activities, is comprised of teachers, mathematics supervisors, representatives from local industries, area universities and colleges, and the Science Museum of Minnesota. The Teacher Advisory Committee is composed of five teachers who participated in one of the collaborative-sponsored Summer Institutes as well as the teacher coordinator; the committee serves as a link between the teachers and the collaborative's administration. Two members of the Teacher's Advisory Committee also serve on the Steering Committee.

During 1986, the Twin Cities Urban Mathematics Collaborative sponsored a wide variety of activities for both junior high and high school mathematics teachers. These included a series of dinner lectures, a seminar series, and the 1986 Summer Institute, which focused on problem solving and enrichment topics for the junior high curriculum. In addition, the collaborative publishes its own newsletter, which is an important networking component of the project. The newsletter is co-edited by the teacher coordinator and the on-site observer.

Technical Assistance Project

Coordinator: Dr. Mark Driscoll
Program Assistant: Ms. Melissa Fox
Technical Assistant: Ms. Grace Kelemanik
Funding Agent: Education Development Corporation (EDC)
Date of Initial Funding: September 1, 1985

The Technical Assistance Project (TAP) was established in September, 1985, in response to individual collaborative's requests for extra support and for increased information. The TAP, funded through the Education Development Corporation (EDC), was initiated to provide technical support to the Urban Mathematics Collaborative project. The TAP's staff of three, draws on other EDC staff and resources in the mathematics and education communities.

Four goals provide a focus for TAP activities: to provide a resource network; to provide opportunities for collaborative members to participate in national and regional symposia, workshops, and pilot projects; to establish communication networks among the eleven collaboratives; and to provide assistance in solving local problems and identifying local resources.

The Director of the Technical Assistance Project has visited all collaboratives at least once to clarify his role and to gain a better understanding of local issues and needs; it is a practice he expects to continue. EDC resources have been used to disseminate information on a wide range of issues and to identify local human resources. A computer network was established in fall, 1986, to facilitate interproject communication, and a quarterly newsletter helps disseminate information to the collaboratives. The TAP was responsible for organizing the annual meeting of collaborative project staffs. In addition, TAP funded teachers from various collaboratives to meet together and sponsored teachers' attendance at national conferences. This year the Technical Assistance Project initiated a meeting of the district mathematics supervisors in cities in which collaboratives are located.

III. OBSERVATIONS AND REFLECTIONS

To provide a framework for our observations about the eleven urban mathematics collaboratives, we must view them in two groups. The first group consists of the seven "established" projects initiated in 1985 (Cleveland, Los Angeles, Philadelphia, San Francisco, Twin Cities, Durham and Pittsburgh); the second consists of the four "new" projects funded in 1986 (San Diego, St. Louis, New Orleans and Memphis).

Information about the activities, concerns, and problems of each site, whether established or new, makes it very clear that each collaborative is unique. The myriad of local social and political problems which impinge on teachers via administrative requirements, curriculum guidelines, and mandated tests are significantly different at each site. As a result, the activities of each collaborative impact on the lives of teachers in different ways. Nevertheless, if one looks beyond local issues, similarities exist across sites; these similarities will serve as the basis for our discussion.

Observations

OBSERVATIONS ABOUT THE ESTABLISHED PROJECTS

The observations in this section are concerned primarily with the established projects. However, many of our comments undoubtedly will apply to the new sites during the coming year.

Last year, we commented on four similarities we had identified in the operations of the initial seven projects (Romberg & Pitman, 1986): activities designed to challenge teachers intellectually, efforts to treat teachers as professionals, debates about curriculum organization and change, and the social and political problems of school reform. This year, we address these four issues, as well as project management and institutionalization, and teacher empowerment in classrooms, schools, and districts.

Activities That Are Intellectually Challenging

The collaboratives' highest priority in 1986 focused on the continuation and expansion of the intellectually challenging activities offered to mathematics teachers in 1985. Whether the opportunity involved solving physics problems at the Exploratorium, interning in industry, using the computer at Phillips Exeter

Academy, listening to an industry mathematician explain the mathematics used in the world of work, or attending a problem-solving workshop, teachers in every collaborative gained new insights into the dynamics of mathematics and its uses.

Here, and elsewhere in this discussion, we will draw on the comments of teachers to underscore our observations. In Los Angeles, teachers attended a series of mathematics workshops. Their comments included: "You can teach an old dog new tricks. I never realized the retail business used this amount of math"; "This is exciting. We are learning about statistics"; "I will try to use a new approach to teaching word problems." After a Hughes Aircraft dinner meeting at which participants were given several mathematical problems to solve, one Los Angeles teacher commented, "I found it very mentally stimulating. The problems Ms. Barkley gave us were challenging." Following a visit to the San Francisco Exploratorium, a teacher from Los Angeles stated that the lesson "made me feel enthusiastic again." In Twin Cities, teachers who attended the Summer Institute commented: "I feel like a mathematician"; "For me, it is a rebirth in mathematics, a wanting to study and learn more about mathematics and to bring some of this back to the classroom." In Pittsburgh, after a tour of a high technology industrial park, a teacher said, "I think that today's experience was personally very gratifying and for the first time I have a little knowledge about the mathematics needed to take advantage of the jobs offered in the present and future." Following a problem-solving seminar in Cleveland, a teacher observed that the seminar was "mind refreshing, away from trivial math," and that "my mind was broadened by different approaches to problems." In San Diego, one teacher commented that the purpose for a collaborative dinner colloquium was to "get us back into being mathematicians rather than into just being teachers," and that "the excitement of mathematics needs to be brought back into teaching."

Teaching is a difficult and demanding job under the best of circumstances, and it is much more difficult in the environment of most urban settings. Teachers in these cities work in an environment in which many parents and the public at large are at best indifferent about schooling and at worst actively hostile. Furthermore, students often reflect this attitude. Yet there are many good mathematics teachers in the cities served by the Urban Mathematics Collaborative project, and the opportunity to participate in activities at each collaborative site makes their jobs more interesting and rewarding. Let us offer several examples.

First, in most districts teachers experience few opportunities to share ideas, discuss issues, or learn about new developments. The most obvious outcome of the projects to date is that those teachers who have become active participants are learning to share and discuss mathematical issues. In particular, a core of teachers has emerged whose participation in a variety of activities over the past two years has enabled them to become revitalized and to assume leadership positions within their schools and districts. In fact, these core groups of teachers constitute new networks, providing peer support to teachers who may be at risk of leaving the profession. In some cases, the core teachers have extended their networking to include mathematicians from business and higher education. The emergence of these groups emphasizes the heterogeneity of the teaching occupation with respect to attitudes, qualifications, enthusiasm, and sophistication. Although some sites have expressed dissatisfaction because all teachers have not become involved, failure to reach all is not failure of the collaborative. The question now becomes how these core groups can begin to influence one another, their colleagues, education administrators, and others.

Participation in collaborative activities has prompted teachers to develop strong identification and linkage with one another. Many teachers have expressed delight at the opportunity to meet with fellow teachers and to share information. In Cleveland, where almost a third of the teachers have participated consistently in collaborative activities, a teacher network has evolved that provides peer support. In Pittsburgh, department heads have formed a functioning group that meets monthly to work on district mathematics initiatives and to socialize. In San Francisco, the teachers who attended the Exploratorium Summer Institute have developed strong links that have carried over into the school year. After a dinner meeting in the Twin Cities for area mathematics professionals, a teacher commented, "Just being with fellow mathematicians is worth so much. I feel different--it has a psychological effect." At a meeting of the Algebra II/Precalculus Network in Durham, one teacher applauded the "sense of cooperation among teachers" and their "great willingness to share ideas," and added that "this 'meeting of minds' is long overdue." At the Durham Mathematics Council's end-of-year reception, a teacher expressed appreciation for the "opportunity to meet and talk with teachers from other schools," and added, "I've had many opportunities that would never have been available to me without the Durham Mathematics Council."

Numerous problem-solving seminars and inservice days sponsored by C^{2}ME in Cleveland have prompted teachers to express their pleasure at meeting and sharing ideas with their peers. One teacher commented, "The chance to get together with other teachers to solve problems is very good." Another affirmed that the strength of these activities is founded in "interacting with others and sharing ideas," and added that "we need to get together as math teachers more often." In Philadelphia, following a Mini-Grant Fair, one teacher commented, "To see other people and be with other people helps you feel like you are a part of a community. Too often teachers are isolated." After a collaborative-sponsored luncheon at the Fall ATMOPAV Conference, Philadelphia teachers expressed appreciation for the "opportunity to talk and exchange ideas with each other." Following an overnight science program for teachers at the Franklin Institute in Philadelphia, a teacher noted that there was "good camaraderie among teachers. Meeting fellowteachers outside of the school building is very intellectually stimulating, as well."

In several collaboratives, the peer support has been extended to include associates as well as teachers. In Los Angeles, for example, the team-building process, workshop development, and interaction between teachers and industry and university associates have lowered barriers between teachers and other mathematics professionals. One teacher stated, "I'm glad to see some industry people working with us. They have good advice." In Durham, following a reception celebrating the collaborative's first year, one teacher expressed gratitude for "the opportunity to talk with the business leaders that sponsored our programs."

Another example of collaborative success involves teachers' time, which is always at a premium. In addition to teaching five classes each day, most mathematics teachers are engaged in regular after-school activities such as coaching. As a result, time constraints pose a serious problem for every collaborative. Some restrictions extend from the intrinsic nature of teaching and from many teachers' views about the job. Many teachers have a work-place mentality in that they are satisfied with their hours and vacations, are reluctant to participate in activities in the evenings, on weekends, or during vacation, and would only consider such participation if remuneration were offered. In addition, teachers are isolated from their peers in a bureaucratic system that fosters this work-place mentality. Many teachers have commented that they had never met their colleagues in other schools before participating in UMC activities. Similarly, few had ever attended a professional meeting or workshop or shared their experiences with other teachers; in fact, in many cities, such professional activities have been actively discouraged.

Due in part to collaborative efforts, this attitude is beginning to change. In Pittsburgh, the collaborative worked with the district administration and the principals to arrange time for teacher inservices, and for regular meetings of the department chairs from the twelve high schools. In the past, the content of the inservices had been determined by the principal and had varied in quality; this responsibility is now being granted to the collaborative to enable teachers to visit local industries. The activities' success has prompted department supervisors to arrange concurrent activities for language arts and science teachers. Thus, principals have come to view inservices as a means of providing teachers with productive content-related activities. Also in Pittsburgh, the department chairs rarely had met as a group prior to collaborative involvement; the group now has found the means and the time to meet monthly. This group has been given increased responsibilities by the district, including the design of a third-year mathematics course.

In Philadelphia, department meetings have assumed a different perspective in some of the high schools and have been used as a mechanism to provide inservice to teachers. At one high school, a series of inservices on problem solving has been offered to mathematics teachers during department-meeting time. Other departments have also met together to review computer software; another held a joint meeting with the school's science department at the Franklin Institute. In some cities, districts refuse to provide time or money for teachers to attend professional meetings; in response, several collaboratives have funded teachers' participation in these events. In Los Angeles and Philadelphia, teachers work together to cover the classes of those who attend such meetings."

In many districts, scheduling constraints act as a deterrent to change. A Los Angeles teacher who wanted to stay with a geometry class into the second semester to continue the students' work with the Geometric Supposer had to make a special request to the principal. In this case, a teacher was successful in changing bureaucratic procedures to provide an instructional experience for students. Also in Los Angeles, a teacher who had worked in the system for more than fifteen years had never had an opportunity to meet the mathematics supervisor; a collaborative meeting allowed him to do so, making the district administration more accessible.

Teachers in urban schools must also contend with limited resources and often minimal administrative and clerical support. Through both direct and indirect support, the collaboratives have been able to help teachers obtain supplies, meeting spaces to congregate, and clerical services. The collaborative coordinator in Philadelphia, for example, works with teachers to help them take advantage of available mini-grants. If needed, the collaborative's part-time clerical support has been available to type proposals. The collaboratives in both St. Louis and San Francisco have provided workshops to help teachers write grant proposals. This year, for the first time, San Francisco mathematics teachers took advantage of the mini-grants provided through the Education Fund, and purchased tables and partitions for a mathematics laboratory, software, a robotics kit, and art supplies to use in teaching mathematics. In Philadelphia, the collaborative has provided teachers with software for use in mathematics classes. In Pittsburgh, collaborative funds were used to provide each mathematics teacher with a classroom set of hand held calculators.

Given the overall age of the teachers in the school districts that have collaborative projects, the number of years they have been teaching, and the last time they had formally studied mathematics, it is not surprising that many teachers are out of date with respect to their knowledge about the developments in mathematics and its expanded uses. Without exception, those teachers who have become involved in their local collaborative have commented on how good it has been to learn and to be intellectually challenged.

Following a probability and statistics workshop in Durham, one teacher commented that the highlight of the workshops was the "opportunity to hear and talk with Dr. Dawson, a working statistician. . . . This is the sort of program I hoped for when the [Durham Mathematics] Council was formed." An Algebra II/ Precalculus workshop in Durham that dealt with the impact of new software on the pre-calculus curriculum was characterized by one participant as "thought provoking." Another stated, "I was persuaded to open my mind to new possibilities." A participant at a problem-solving weekend co-sponsored by Oberlin College and the Cleveland collaborative remarked, "I loved it because we worked together with other math teachers . . . and did real mathematics." A participant at a dinner colloquium in San Diego, at which the Fibonacci numbers were discussed, stated, "It was good for me to see that sort of thing again." Following a tour of three high-tech companies, which was sponsored by the Pittsburgh collaborative, one teacher commented that the tour "updated my knowledge of the high-tech job market and descriptions of the math involved. I have a better knowledge of what high-tech industries are."

In summary, although the activities of the collaborative projects often were initially approached with suspicion and little enthusiasm, the isolation and indifference are now being overcome. In every site, project participants have enthusiastically gained from their experiences. This professional and intellectual refreshment continues to be the most important outcome of every collaborative project.

Treatment of Teachers as Professionals

An important feature of collaborative activities is that teachers are now being treated as professionals. Rather than giving teachers materials or procedures that they were expected to implement, the collaborative's expectation has been that teachers would become more familiar with the issues and the problems and have a say in the solutions. Teachers are viewed as partners and concerned professionals in the educational process, and their ideas are now being respected. Many teachers initially viewed this approach with suspicion, because in the past teachers often have been treated as passive clients rather than as colleagues. The corporate dinners and visits to industries and universities, however, gave teachers an opportunity to interact with industry and university mathematical scientists. Teachers in all the collaborative sites appreciated both the opportunity to be with industry and university mathematicians and the mutual respect that was expressed. The relations between the teachers and mathematicians in business and higher education have been changing. In the Twin Cities, for example, the Teacher Advisory Board is gaining more influence in the planning of the collaborative. In many collaboratives, teachers who have been funded to participate in conferences have presented workshops for teachers in their own school district, an opportunity many have never before had. In Los Angeles, teachers working with other professionals on the workshop series have been given the responsibilities of developing and presenting the workshops.

One feature of many of these interactions has been an improvement in the quality of the relationship between teachers and other mathematics professionals. In San Francisco, teachers who attended the Summer Institute at the Exploratorium offered several significant contributions to the Exploratorium staff on how certain exhibits should be presented to make the mathematical concepts more meaningful to children. In Los Angeles, the relationship between industry associates and teachers has prompted the exploration of how more people from industry could be made more accessible to teachers. Ideas being explored include teaming one industry associate with two or more teachers to serve as a resource when the teachers need a certain application for a particular topic. In addition, the collaborative is exploring whether corporate retirees could be enlisted to assist teachers. In Pittsburgh and in the Twin Cities, teachers work with potential speakers prior to an industrial site visit to ensure that the talk or visit is relevant to teachers and their needs.

A sense of professionalism and membership in a larger group of mathematics professionals is emerging at each site. At some sites, only a few very active and involved teachers have sensed a change. At other sites, through collaborative dinner meetings and other presentations, teachers have developed a renewed sense of membership in a larger professional community. In Durham, for example, the Triangle Mathematics Club is being organized to involve mathematicians from business and higher education, as well as teachers. At some sites, the renewal stems from personal interaction. At others, it stems from a national authority on atmospheric chemistry who sits with three teachers and discusses the role of testing in teaching and the value of different mathematics applications. It stems from a nobel laureate who sits at a table with seven teachers and talks about the influence a certain teacher had on his own life. It stems from a teacher who feels able to bring a teaching issue to a dinner meeting where she knows that fellow teachers and associates from universities and industry will be available to discuss the issue and offer her some ideas. The changes in teachers' attitudes about their own professionalism are subtle, but they are there.

Curriculum Organization and Change

The problems of curriculum organization and change have been debated at each project. At each site, personnel are attempting to understand the changes occurring in the field of mathematics and the impact these changes may have on teaching, both in relation to new topics and in approaches to teaching.

One apparent change that has taken place in several sites has been the increased use of computers in the mathematics classroom. In Twin Cities, Cleveland, and Philadelphia there has been a new emphasis on problem solving and on increasing teachers' awareness of what problem solving is, how it can be integrated into the classroom, and how problem-solving materials can be developed and acquired for classroom use. The work of the Pittsburgh mathematics department chairs to design a third year mathematics course and of a committee of Cleveland teachers to develop end-of-semester mathematics tests are other examples of teachers' influence on curriculum. The collaboratives have created an awareness of new topics and teaching methods. More teachers now have an idea of what is meant by discrete mathematics, problem solving, and mathematics applications.

In addition to discussing change, some teachers tested new ideas in their classrooms. A Los Angeles teacher gave her Algebra 2 class a truss application she learned about at a collaborative workshop. In Cleveland, teachers collected problems and produced problem-solving kits designed for classroom use. The impact of computer instruction for Philadelphia teachers has resulted in a profound change in classroom teaching; students' activities now include exploring different hypotheses using the Geometric Supposer and spread-sheet computations.

Institutional Reform

Teachers in each site are beginning to become aware of the social and political problems related to curriculum and instructional reform. They recognize the need for time to reflect, the need for additional training, and the problems inherent in developing materials for implementation in a classroom. Traditionally, teachers have been treated as conduits in a system, with the assumption that their only responsibility was to teach students in a classroom. However, if teachers are to become real partners in a reform effort (which would involve developing materials, testing them, and discussing ideas with others), they will need time to plan, to develop, to reflect, and to evaluate. Furthermore, many teachers are now beginning to realize that their mathematics background is outdated, with their training often reflecting only the content of the NSF Institute programs of the 1960s. After seeking new applications from industry, teachers are asking for concrete applications for use in their classrooms. All teachers realize that instructional materials (texts, software, tests, etc.) must be developed, although not every teacher or school district should develop these materials independently. At the same time, no teacher should be wholly dependent on others' materials.

Project Management and Institutionalization

During their second year, many of the projects recognized a need to restructure their staffs. As new ventures, they were required to sort out roles and responsibilities among staff members. In a pattern common among collaboratives during their first year, project directors viewed themselves as fiscal managers with several responsibilities, only one of which was the management of the UMC. A project coordinator was hired (usually part-time) to establish schedules of activities, to make arrangements, and to attend to details. As tasks have become more clearly identified, however, other individuals (mathematics supervisors, teachers) have assumed responsibilities for some of them. In fact, because the established projects were required to submit a proposal for refunding, they were forced to rethink their organizations and work management. The proposal required the projects to describe some means of finding matching funds, and to outline a long-term plan. In the process of writing their refunding proposals, project directors were forced to reevaluate their own involvement with collaborative activities. In some cases, a change in the administrative structure of the collaborative resulted. In San Francisco, for example, the position of coordinator was restructured to create a director of development and community relations and a teacher coordinator. In Twin Cities, the director envisioned a more involved role of the Teacher Advisory Committee in collaborative planning. During the next two years, we will learn how the activities, funding, and management of the projects will evolve to institutionalize the collaboratives' activities and ideas in their communities.

Several secondary effects in the institutionalization of the collaborative have been noted. Particularly at those sites that have an education fund, collaboratives in other content areas have sprouted. This has resulted in a number of the mathematics collaboratives becoming mathematics/science collaboratives (Los Angeles and Philadelphia) or in having a science collaborative formed using a similar structure (San Francisco and Cleveland).

In a similar manner, the roles and composition of advisory groups have evolved. From their initial identification as community-based support groups, they have become much more active in fund raising, scheduling, and event planning. In several collaboratives, the advisory boards met initially to review ideas and plans presented by the director or coordinator but did not provide much direction. A conscious effort by the director and by the board itself is required if the advisory board is to begin to become more directive and initiate ideas. In Pittsburgh, the advisory board remains at stage one; it will discuss an issue but does not take much action. The advisory board feels comfortable with this type of role and meets only twice each year. In Philadelphia, activities are planned by an advisory council composed of the collaborative administration, six teachers representing the target schools, the district associate director for mathematics, as well as other key individuals. The board meets every other month. The advisory structure for the Twin Cities collaborative, in contrast, consists of a steering committee and a teacher advisory group. This organization has evolved so that ideas, activities, and plans are initiated in the steering committee and then passed on to the teacher advisory group, which evaluates the ideas and plans for implementation. Two teachers are members of both groups and provide a communication link. A version of this two-tier advisory structure has also been adopted by the Los Angeles collaborative. An advisory board, referred to as the Urban Mathematics/Science Collaborative, initiates ideas and specifies policies. Programs, such as the +PLUS+ Workshop Series, are planned and implemented under the guidance of steering committees formed for specific activities.

The appropriate advisory structure for a collaborative has not been rigidly defined but rather has evolved out of the direction, focus, and needs of each individual project. Developing the appropriate advisory structure requires both effort and a clear idea of the structure's goals and responsibilities.

The most vexing problem has been the role of teachers in project management and planning. Too often, teachers expect and receive services in a paternalistic manner. However, project staffs and teachers are aware of this problem and are starting to work on changing this relationship. In the Twin Cities, for example, the role of the Teacher Advisory Committee has been expanded to focus on planning and implementing activities. In Los Angeles, teachers serve on the advisory committee.

The newer collaboratives have benefitted from the experiences of the more established ones and recognize that teacher involvement is important from the start. In St. Louis, teachers were actively involved in writing the original project proposal; in San Diego, a teacher advisory committee was considered essential from the beginning; in Memphis, a number of teachers have been included on the collaborative advisory board; and in New Orleans, teachers have assumed leadership roles and major responsibilities on the four working committees that plan and implement collaborative activities.

Finally, the relationship between the activities of the collaboratives and the goals of the school district (and, in some instances, the states) are unclear. In some cases, the activities have been deliberately designed to support the district's goals. In Pittsburgh, for example, collaborative activities have been associated with developing a mathematics course for the district. In Philadelphia, collaborative resources have been used to support the district's Mathematics In Application course. In most sites, however, collaborative activities developed independently of the district's goals and are only now being negotiated. In the Twin Cities, initial activities included Summer Institutes and professional meetings during the school year. Although the two cities' mathematics supervisors have always been active, collaborative activities did not consciously relate to district initiatives or plans. Now the relationship between the collaborative and the districts is being reconsidered to determine how the districts' administrations can be more aware of and involved with the collaborative.

The mathematics supervisor is clearly a key individual in the developing relationship between the collaborative and the district. In Cleveland, the close relationship between the mathematics supervisor and the collaborative administration results in almost daily telephone calls to keep the information flowing. In Pittsburgh, mutual respect between the district's associate director for mathematics and the collaborative coordinators has fostered a situation in which the work of the district and the collaborative are so integrated that it is difficult to determine who is the sponsoring agent. The lack of a mathematics supervisor in San Francisco made it more difficult to develop a solid relationship with the district. With the arrival of a new superintendent and the appointment of a teacher who is an active participant in collaborative activities as the part-time mathematics supervisor, a working relationship is developing with the assistant superintendent responsible for curriculum. Some supervisors are beginning to become aware of the collaborative's function and the potential for establishing such a beneficial relationship with it. This awareness was enhanced by the meeting that the Technical Assistance Project sponsored for the mathematics supervisors in December.

Teacher Empowerment

Evidence of teacher empowerment has appeared at two levels in some of the collaboratives. On one level, individual teachers have taken more initiative in bettering their own situations, or the situations of their students. On a second level, the district has granted authority to a group of teachers to perform some task or fulfill some responsibility. At the individual level, the actions of some teachers would suggest that they are feeling more empowered to take action. A young Los Angeles teacher who was seriously considering leaving teaching became motivated enough to establish a tutoring program involving college students.

At some sites, the direct efforts of the collaborative administration, or the realization that teachers can make a real contribution in district operations, has prompted several districts to grant teachers special responsibilities. In Cleveland, the mathematics supervisor has assigned a group of teachers responsibility for developing district tests for several mathematics courses. In Pittsburgh, the superintendent granted responsibility for development of a course to the mathematics department chairs. This empowerment seems to result from increased interaction among district administrators and teachers in collaborative activities and from an identification with a project which has the purpose of fostering teacher involvement.

OBSERVATIONS ABOUT THE NEW PROJECTS

The four new sites have the advantage of the experiences of the seven established collaboratives in answering some of their initial questions about organizational structure, teacher involvement, and collaborative activities. On the other hand, the newer sites face the burden of being the younger child and having the older child restrict the vision and hamper the creativity needed to come up with new ideas. In most cases, the second wave has taken less time to get started, as evidenced by the activity of working committees in New Orleans and the establishment of a speakers' bureau in Memphis. A major advantage for the newer sites was their opportunity to question the more established collaboratives about what seems to work. Another factor has been the assistance available through the Technical Assistance Project at EDC and that Project's ability to relate specific examples from the more established collaboratives in answer to the questions of the newer ones. The initiation of Common Ground, a computer network, should make information sharing between the collaborative projects and the Technical Assistance Project easier and should also facilitate communication among the collaborative projects themselves.

Reflections

The organization and activities of the collaborative projects during this past year are summarized under five topics: collaboration, increased professionalism, curriculum reform, mathematics focus, and other fundamental issues about schooling.

COLLABORATION

A central feature of each project is the collaboration between mathematicians from business, industry, and universities with secondary mathematics teachers in an urban setting. Each project, however, was established based on local strengths and experiences. For example, in Minnesota, support stems from the strength of the School of Mathematics and its experience with teachers throughout the state. In Philadelphia, strength comes from the Franklin Institute, its background, and its experience in dealing with teachers from the perspective of a Science Museum and from the strong leadership of the mathematics coordinator in the Philadelphia School District. In Cleveland and Los Angeles, the background and expertise of the Public Education Fund in soliciting and using corporate funds to support educational programs provided strength.

The strength of such organizations and the structural relationships with influential local groups and individuals were critical in initiating each of the projects. Last year we mentioned the possibility of these strengths also contributing to an initial weakness in the evolution of the projects. The difficulties encountered by most of the projects, however, were not in capitalizing on their own strengths, but rather in gaining support from other elements. Los Angeles and Cleveland, for example, were initially very successful in establishing industrial support but had difficulty securing university involvement, while just the opposite was true in Minneapolis and San Francisco. During the past year, the collaborative projects worked to increase the participation of other mathematics professionals. In Los Angeles, for example, a concerted effort was made to include university and college professors on the steering committees that were planning the fall +PLUS+ workshops. Through the work of these committees and, in some cases, through members' recruitment efforts at universities and colleges, several representatives of the higher education institutions made presentations at the workshops. For example, Bill Lucas, a professor at Claremont Graduate School, developed and presented all four of the sessions on one workshop topic. In Cleveland, a relationship has been established with local colleges; Oberlin College, for example, provides workshops on problem solving for mathematics teachers in the Cleveland area. Colleges and universities also have written grant proposals for activities that would involve members of the Cleveland collaborative. In this cooperative venture, the colleges obtain money, and the collaborative provides the teachers and the environment. The grants can then be considered as part of the collaborative's local matching funds.

All of the collaborative projects operate within districts that offer some other mathematics and science activities. In communities like Philadelphia and San Diego, a rich array of activities are available to mathematics teachers; the availability of activities in other collaborative sites, such as Durham and Cleveland, seems minimal in comparison. Thus, it is necessary to examine the relationship between collaborative-sponsored activities and other on-going local activities that serve the same audience. Clearly, these activities should be complementary, but how distinct they are depends on the goals of the collaborative and the kind of activities it undertakes. Over the next three years, we expect to see changes in the projects as each builds interdependent relationships and structures within its own district.

Another aspect of collaboration deals with school district administrative support for the projects' activities. Although many administrations welcome the opportunity for teachers to participate in a variety of activities, currently there is nominal support at most sites from school administrative personnel.

In some cities the collaborative projects are, in a sense, subversive: they alert teachers to a reform movement that challenges the traditional ways of organizing and of teaching mathematics in the schools. It is clear that some administrators are suspicious of the proposed changes in course structure, texts, tests, and methods of teaching now under consideration by collaborative participants. This is not the case in all school districts, however. In Pittsburgh, for example, the activities of the collaborative have been wedded to the goals of the district from the start; a strong mutually supportive relationship has developed in Cleveland and Philadelphia and is developing in Memphis.

Development of local models of collaboration based on individual strengths and energies at the site have resulted in a variety of models and views of the collaboratives. In some cases, where a focus has been placed on raising funds and disbursing them in the form of activities, materials, or grants, collaboration is viewed as a clearinghouse. In one form of the clearinghouse model, collaborative staff provide resources and support to teachers. In another model, collaboration has manifested itself as team building. In this case, the focus is on forming groups of people who become attached to one another and want to associate and work together. In some instances, the groups have included representatives of the schools, business/industry, and higher education. In other cases, the groups have involved teachers or department heads exclusively. Another model views the collaborative as an administrative structure that will disappear when the desired new relationships involving teachers are in place. In this case, energy is expended to ensure that the correct links have been established with the district, union, and other key people, and that there is proper coordination among all. A fourth model resembles a special interest society; this model emphasizes participants' attendance at a series of dinner meetings and seminars, allowing for both group interaction and a speaker to present a talk on some topic of interest.

These models depict strategies and views that have been expressed to describe the workings of the individual sites. There are, however, no pure forms of any of these models; each collaborative generally represents elements of several. The clearinghouse and provision-of-resources-and-support models are prevalent in Cleveland, San Francisco, and Philadelphia. Team building has been emphasized in Los Angeles and among department heads in Pittsburgh. Administrative structure and links have been the focus in Pittsburgh. In Twin Cities and somewhat in Durham, the fourth model has been highlighted. It is too early to characterize the newer collaboratives.

INCREASED PROFESSIONALISM

A primary rationale underlying the establishment of the Urban Mathematics Collaborative project is to increase teacher professionalism. Too often, teachers are isolated from their peers in buildings, from other teachers in the district, from ideas about mathematics and the teaching of mathematics, and from the process of change. Teachers often are not treated as professionals because they are implementors of others' work; because they have reduced decision-making authority as a consequence of legislation or district policies; because they are involved in a deficit model of staff improvement and have little time or space for planning or engaging in professional activities.

It is not clear, however, that teachers are accustomed to thinking and dealing with issues professionally. Training of department chairs and of informal leaders in departments is needed. The teachers involved in the collaborative projects are excited about the opportunity to discuss problems and to work with others to improve mathematics teaching. Although they are accustomed to working independently, most feel it is essential to work with others. In nearly all cases, teachers have welcomed the opportunity to meet with their peers as part of the activities sponsored by the collaboratives. But real effort is needed before teachers will begin to believe that they, with the cooperation of others, have the power to change the teaching situation. Some have expressed the opinion that projects come and go and that the mathematics collaborative is no exception. However, after having attended a collaborative-sponsored event--a workshop, a Summer Institute, a dinner meeting, or a professional conference--these teachers come away with renewed interest in teaching and a revitalized willingness to try something different. A teacher in Minneapolis, for example, considered leaving the profession and looking for something to give her a spark; then, she enrolled in the collaborative's Summer Institute. Eighteen months later, she happily recalled the experience and reported that the Institute gave her the boost she needed to keep going and a different perspective on the teaching of mathematics.

CURRICULUM REFORM

Initially, the opportunity for curriculum reform was viewed skeptically by most teachers. As a result of participation in collaborative activities, however, many teachers are beginning to recognize the need to teach new mathematical ideas. This realization has resulted from an exploration of mathematics in the world of work and an investigation of problem solving through collaborative activities. However, the translation of these ideas to classroom practice and curricular content is not obvious. Curriculum reform implies a change in the current status of the curriculum. Some teachers believe that we can make ameliorative and not radical change (Romberg & Price, 1983). Others feel that we cannot simply add new material to existing programs, but rather must alter texts and tests. Finally, in working toward change, teachers are unsure about how to use external resources. For too long, materials simply have been distributed to teachers without offering them an opportunity to reflect, to think, or to argue about their goals or their methods. Today, this situation is changing, but most teachers remain unaware of how to ask for and use external resources. During the past year, however, this, too, is changing as a result of collaborative attempts to involve teachers in creating new curricular materials and in new decision-making procedures about curriculum. This change is not only in instructional materials and content. If the change is to reflect the problem, then there must also be pedagogical changes so that problem solving, for example, does not become an algorithmic area alongside of arithmetic, algebra, geometry, and the calculus.

Some good examples of curricular change are emerging. After attending the 1986 Summer Institute sponsored by the Twin Cities Urban Mathematics Collaborative, a St. Paul teacher integrated problem solving into his teaching as an approach that students should apply continually. He posted a list of problem-solving strategies on the front wall and continually refers to it as he teaches. At the district level, collaborative teachers are becoming involved in developing course curriculum, such as the third-year mathematics course in Pittsburgh and the Mathematics in Application course in Philadelphia. These courses embody a step toward curriculum reform, integrating problem solving and the use of computers into the teaching of mathematics.

MATHEMATICS FOCUS

The eleven collaborative sites have differed in terms of their mathematics focus. Both the Twin Cities and Cleveland have emphasized problem solving, Twin Cities in the Summer Institute and Cleveland in its workshops and problem-solving kits prepared for classroom use. In both Pittsburgh and Philadelphia the mathematics focus has been derived primarily from district direction and has included computers and calculators in the classroom, applications in mathematics, and problem solving. In San Francisco, presentations and activities have been directed toward the use of mathematics in other professions. In Los Angeles, workshops emphasized discrete mathematics, applications, and the use of computers in the teaching of mathematics.

It is clear, then, that collaborative teachers are being exposed to new ways of viewing mathematics. In some cases, they have come to understand different topics or different ways of organizing topics as a result of increased knowledge about discrete mathematics, operations research, and game theory. In other cases, the different view of the nature of mathematics and of doing mathematics results from looking at problem-solving strategies and the dynamics of mathematics. In still other cases, the power of mathematics is recognized through its many applications and the ways in which mathematics is helping to reveal the physical world and to extend technology. This combination of teachers' experiences helps to break the traditional view that divides mathematics into neat compartments of arithmetic, algebra, geometry, and trigonometry.

OTHER FUNDAMENTAL ISSUES

Some issues associated with the teaching and learning of mathematics today have not as yet been fully addressed by the collaborative projects. Two fundamental issues should be mentioned.

First, teachers are largely unaware of the revolution in psychology that illuminates how information is learned and stored. Learning is not absorption, but creation. Students come to school already possessing primitive notions about how to do much of mathematics. Teaching is not pouring more ideas into students' heads; it is helping them to acquire and construct certain strategies or techniques for doing mathematics.

Second, there is a social/political dimension to teaching that is being brought to the attention of the teachers participating in the collaboratives: mathematics is a commodity that is being differentially distributed to students. Different students have different opportunities to learn different things. Central to this are the issues associated with minority students and equity. These issues are being addressed in collaboratives' presentations on teaching mathematics to the disadvantaged student and at the lower achiever. However, in most sites, these issues have only been touched on. More should be done.

In conclusion, only when the teachers begin to address these more fundamental issues will they begin to make the kind of progress toward educational reform that underlies this initiative.

IV. FINAL COMMENTS

This second year for the seven established Urban Mathematics Collaborative projects and the initial year for the four new projects has been exciting, enriching, and challenging for the participating teachers, for the staff of each project, for the Technical Assistance Project, and also for us, the staff of the Documentation Project. In this regard, five comments about what we have learned are in order.

First, the need for a documentation project has now been verified. Prior to starting this project, it was easy to argue that such a monitoring effort was necessary for any reform effort (Romberg & Price, 1981). During these first two years, we have been able to identify substantial educational problems as they were emerging; the need to document their evolution remains imperative. For example, as teachers gain confidence and increased status, and therefore begin to demand self-control, it is important that we document the potential tension between those teachers and school administrators and how that tension is resolved via negotiation. Successful project experiences should lead toward risk-taking opportunities for teachers, consonant with reform efforts. The degree to which risks are actually taken and how other teachers, union leaders, and administrators respond is going to be very interesting to observe and document.

Another educational issue that merits documentation is the emerging premise that, if one can facilitate collaboration among teachers, and between teachers and representatives of business and higher education, quality mathematics instruction will be developed. The nature of collaboration between teachers and industrial and university mathematicians still is being operationally defined by the sites. The key to productive collaboration is due not to institutional commitments, but to people and their personal willingness to become and to stay involved. In this regard, it is obvious that many teachers need assistance in learning to assume leadership roles. Also, it is important to study whether the mechanics of collaboration will enhance or obscure the quality of mathematics instruction. Collaborating simply to make the current curriculum more efficient would be counter to the goals of the reform movement. Furthermore, teachers in urban schools work in an environment in which parents and the public at large are at best indifferent about school, and frequently hold teachers in low esteem. Students often reflect these attitudes. It has become apparent that current data-gathering is not shedding light on changes in these areas. We think such changes are possible and need to plan how such evidence can be gathered.

These examples of educational issues related to the emerging school mathematics reform movement have become apparent. Other issues will surface in the coming years; all will warrant study.

Second, the wisdom of the Ford Foundation's funding policy is becoming apparent. The system of seeking long-term guidelines with short-term funding proposals is working to the benefit of all. The changes in strategies and focal problems required by the preparation of refunding proposals reflects real progress. The evolution of collaborative networks within the complex social arrangements of cities is not linear. Providing the collaborative projects with the flexibility to change target populations, to start new activities, to make long-term plans, and to make other changes as needed is an excellent approach to the funding situation.

Third, the importance of the collegial relationship that has evolved between the Documentation Project and each site was unanticipated. Being viewed as documentors who are vitally interested in making the projects successful has become both rewarding and demanding. Initially, we were viewed with some suspicion, but we did not present ourselves as inspectors. Now we are being called on to help in a variety of ways. The attention given to a site by the documentors, even when it is as unintrusive as possible, has a positive effect on the site. Documentors' site visits are considered a time to "show off" what has resulted from a considerable amount of work by the collaborative. It is also a time to sit down with teachers to discuss what they are doing. Frequently, a teacher's parting response is, "Thank you for visiting my class," or "It was nice to talk with someone who listened." For teachers, there is something special about having someone from out of town show interest in classroom activities. Teachers have been very willing to have documentors sit in their classes; at times it is difficult to visit all those who issue an invitation.

Fourth, in a similar manner, a collegial relationship is emerging among the eleven UMC projects. The Urban Mathematics Collaborative project has a distinctive identity among efforts directed at national funding of independent sites. This has evolved from the conscious establishment of a supportive network of communication among funding agents, coordinators, and core teacher groups across sites. Initially, information was passed through Barbara Nelson, the Ford Foundation project officer, and the members of the Documentation Project. The Technical Assistance Project (TAP) was established in response to the perceived desire and need of people at the sites to compare experiences, learn from each other, and know that their concerns were often shared.

The role of the TAP is emerging as a key component in the development of a sense of community. Visits by Dr. Driscoll, the director of the TAP, the establishment of a computer network, the sponsorship of activities at the Phillips Exeter Academy, the production of the newsletter, and hosting the meeting of district mathematics supervisors do more than simply "move ideas around." The contribution of the TAP to the overall quality and character of the entire UMC project should not be underestimated. With the establishment of a trusting relationship between the collaboratives and the Ford Foundation, the Technical Assistance Project, and the Documentation Project, it has been possible to hold regular meetings among the TAP, the Documentation Project, and Dr. Nelson. These tripartite meetings have facilitated better understanding of what is happening in the individual projects against the backdrop of the current general reform debate.

Finally, it is clear that our strategy for gathering information about the projects has been fortuitous, initially in need of more structure, and, in some respects, limiting. The complementary nature of the interests and insights of Allan Pitman, Norman Webb and Project Director Thomas Romberg, in conjunction with the administrative talents of Susan Pittelman, have been fortunate. Pitman brings external background to the problems of organizational structures and professionalism that have shed new light on the emerging problems. Webb brings a wealth of experience in dealing with teachers and their concerns, which adds a sense of realism to our data. Romberg, a well-respected expert in the field of mathematics education, provides both a vision of school mathematics and extensive experience in educational evaluation. Pittelman adds the organizational and personnel skills essential to the success of a major data-gathering endeavor. Similarly, the importance of the on-site observer at each site is clear.

The need to structure the voluminous information about project activities and developments became pressing as number of sites increased. During this year, we have developed an extensive data file; it has proven invaluable in completing this report, which is far more comprehensive than our 1985 Annual Report.

In all, this second year has been a good year, reflecting the growth and evaluation of the efforts of collaboration and reform at each site.

REFERENCES

Conference Board of the Mathematical Sciences (1984). New goals for mathematical sciences education. Washington, DC: Author.

Romberg, T. A., & Price, G. G. (1981, February). Assimilation of innovations into the culture of schools: Impediments to radical change. Paper presented at the NIE Conference on Issues Related to the Implementation of Computer Technology in Schools, Washington, DC.

Romberg, T. A., & Pitman, A. (1985). Annual report to the Ford Foundation: The urban mathematics collaborative projects (Program Report 86-1). Madison, WI: Wisconsin Center for Education Research.

Romberg, T. A., & Price, G. G. (1983). Curriculum implementation and staff development as curriculum change. In G. A. Griffin (Ed.), Staff development: Eighty-second yearbook of the National Society for the Study of Education (Part II). Chicago: University of Chicago Press.

APPENDIXES

SUMMARY REPORTS FOR THE ELEVEN URBAN MATHEMATICS COLLABORATIVES
AND FOR
THE TECHNICAL ASSISTANCE PROJECT

A. Cleveland Collaborative for Mathematics Education (C^{2}ME)
B. Durham Collaborative: The Durham Mathematics Council
C. Los Angeles Urban Mathematics/Science Collaborative (LAUM/MC)
D. Memphis Urban Mathematics Collaborative
E. New Orleans Mathematics Collaborative (NOMC)
F. Philadelphia Math Science Collaborative
G. Pittsburgh Mathematics Collaborative
H. St. Louis Urban Mathematics Collaborative
I. San Diego Urban Mathematics Collaborative
J. San Francisco Mathematics Collaborative
K. Twin Cities Urban Mathematics Collaborative
L. Technical Assistance Project (TAP)

The following reports are brief summaries of each of the eleven urban mathematics collaboratives funded by the Ford Foundation in 1986 as well as of the Technical Assistance Project. Although the reports were prepared by staff of the Documentation Project, the content of each report was approved by the project.

SUMMARY REPORT:
CLEVELAND COLLABORATIVE FOR MATHEMATICS EDUCATION (C^2ME)

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the Cleveland Collaborative for Mathematics Education. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Cleveland Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco of representatives of all of the projects; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

CLEVELAND COLLABORATIVE FOR MATHEMATICS EDUCATION (C^2ME)

A. Purpose

The purpose of the Cleveland Collaborative for Mathematics Education as stated in its proposal for continued funding is:

1. to provide professional enrichment opportunities for teachers;
2. to provide opportunities for teachers to increase their understanding of mathematics and its current applications; and
3. to facilitate sharing, communication, networking, and collegiality among teachers and mathematicians from business, industry, and higher education.

To accomplish these goals, C^2ME has developed a four-year work plan in cooperation with the Cleveland Public Schools and participating teachers. The plan specifies participants and outlines activities designed to enhance the collaborative's efforts to advance and reform the secondary school mathematics curriculum of the Cleveland Public Schools.

B. Context

C^2ME operates in a community that has experienced a long history of educational upheaval; 1986 was no exception. Among the many changes which occurred in Cleveland in the past year, six in particular will impact on the collaborative's development.

First, in June, 1986, Superintendent of Schools Ronald Boyd was asked to resign. The Board of Education paid $300,000 to buy out the remaining three years of his contract. Three reasons were cited: Boyd's inability to manage the district's finances to the board's satisfaction; the state takeover of the school system; and a volatile student community situation caused by lack of logistical coordination and poor transportation planning for the summer session. In all, the situation reflected a lack of leadership in a tense and difficult political environment. In August, Alfred D. Tutela was named the new superintendent. Tutela had served as interim superintendent after the death of Fred Holiday in 1985. Public reaction to Superintendent Tutela's performance during his first four months has been very positive; he has been praised for greatly improving morale and for taking steps to set a cooperative tone in school district operations.

Second, in September, 1986, the Cleveland Public Schools adopted a middle school concept and moved the ninth grade into the high school. Based on seniority, mathematics teachers were offered the opportunity to stay at the middle school or to move to the new high school program. Due to this upheaval, many math teachers were involved in teaching math courses they had never taught or had not taught in many years. The need for teacher inservice became apparent.

Third, in May, 1986, it was announced that each of the twelve comprehensive high schools in Cleveland would participate in an effort to win a "Magnet School Assistance Grant" from the federal government. Each school could qualify to receive up to $20,000 for such purposes as teacher inservice, personnel costs, and teacher and student supplies. Grant requests were required to relate to a specific theme: these themes are being developed by teacher teams at each high school, and at least one of the themes will be related to mathematics.

Fourth, in December, 1986, the Cleveland Education Fund received a three-year grant from the Carnegie Corporation of New York to develop a science collaborative similar to C^2ME.

Fifth, the collaborative has made arrangements to cooperate with Oberlin College to offer teachers summer workshops on problem solving; the collaborative also will tap into the college's resources throughout the academic year. This promises to be a profitable arrangement.

Finally, the Cuyahoga Community College recently has completed an advanced technology center at its metropolitan campus. Due to the facility's location, it is likely that the collaborative will use it at some future date. This possibility is currently being explored.

C. Development of the Collaborative

The proposal for refunding C^2ME reflected the initial success of the project's activities and the favorable response they received from teachers. The proposal discussed building upon these successful activities; no major restructuring or redirection of the project was indicated, nor did any seem warranted.

Paula Anderson continues to direct the collaborative project. Harriet Jakob, the project coordinator, resigned in June to attend medical school. She was replaced by Bryan Powers, who had taken early retirement from the district after having been a secondary science teacher consultant in the science office for several years. In December, Suzanne Haggerty was hired to assume the coordinator's position. Suzanne is a senior at Oberlin College with a major in mathematics and a minor in computer science. Bob Seitz, a mathematics teacher in the Cleveland High Schools, is the on-site observer and the editor of the collaborative newsletter.

During 1986, the Department of Defense and AETNA Insurance Foundation were identified as new sources of support for the collaborative. In October, AETNA representatives joined the C^{2}ME Advisory Board and awarded the collaborative a grant of $22,000. The Department of Defense committed itself in January to helping to identify written mathematics resource materials. It also will sponsor a winter dinner meeting in the subject of resources for teachers to be offered to mathematics department chairs of junior and senior high schools. In addition, it will arrange a visit to a defense facility in June, 1987, to enable ten to fifteen Cleveland mathematics teachers to receive four days of intensive training on the mathematics background needed by graduates in order to take advantage of career opportunities in the military.

Formation of the Teacher Advisory Board (TAB)

A Teacher Advisory Board, composed of eleven teachers, was formed in January, 1986, to discuss the needs and goals of Cleveland's secondary school mathematics teachers and to develop short- and long-range plans for C^{2}ME activities.

Members of the Teacher Advisory Board were selected by C^{2}ME in consultation with the Cleveland Public Schools supervisor of mathematics. Teachers were selected based on their pattern of participation in C^{2}ME's programs and on their dedication to excellence in mathematics education in the Cleveland Public Schools. The first meeting of the Teacher Advisory Board was held January 28, 1986. After meeting twice more in February, the board drafted an evaluation of C^{2}ME's programs and offered suggestions for future programs. The Teacher Advisory Board then discussed its recommendations with those members of the Advisory Board involved in higher education. Richard Wittman, mathematics teacher at an intermediate school, volunteered to act as spokesperson for the Teacher Advisory Board; he described the board as having some "real movers and shakers." Members of the Teacher Advisory Board also were present at meetings of the Program Planning Committee to discuss programs to be implemented during the next two years. The Teacher Advisory Board met on November 13, 1986, to discuss future activities of C^{2}ME.

Advisory Board

A thirty-two member Advisory Board oversees the operation of C^{2}ME. Members of the Advisory Board include scientists; engineers; mathematicians; educators (secondary and post-secondary); and professionals in finance, accounting, and applied mathematics (product design and technological advancement). Seven Cleveland

Public Schools mathematics teachers and the Cleveland Public Schools supervisor of mathematics also serve on the board. A local professional society (The Greater Cleveland Council of Teachers of Mathematics) and another educational project (EQUALS) also are represented.

The Advisory Board meets five to six times a year. The flexibility of the board permits and encourages the addition of new members as needed; new members are accepted by the consensus of present members. All Advisory Board members serve three-year terms, and successive terms on the board or on a committee are allowed.

In December, 1986, Barbara Nelson and other Ford Foundation officials attended an Advisory Board meeting and were impressed by a nucleus of teachers who were concerned enough about the school system to devote time and energy to see that students receive a quality education.

D. Relationship with Other Local Initiatives

In contrast to some of the other collaborative sites, C^2ME was "the only show in town" when it was funded in 1984. Thus, it was not forced to compete with other agencies for teachers' time and attention. This situation, however, may change as a result of the magnet school grant and in the face of a potential science collaborative.

Three proposals have been funded by the Ohio Board of Regents, which, when combined, will provide more than $140,000 for programs geared to mathematics and science teachers. The first proposal, submitted by Cuyahoga Community College, is directed towards both mathematics and science teachers. The second proposal, submitted by Baldwin-Wallace College, is designed to provide help to underprepared seventh- and eighth-grade mathematics teachers in the areas of problem solving, technology and content. A retirement buyout, effective in June, 1987, coupled with a critical teacher shortage in mathematics nationwide, assures that most teachers of intermediate school mathematics in Cleveland public and private schools during the 1987-1988 school year will be underprepared. These teachers will hold valid K-8 certificates, which require between zero and three lower division college-level mathematics courses. The third proposal, submitted by Cleveland State University, would fund two three-week courses during the summer of 1987, one in algebra and one in analysis. Teachers will receive four graduate credit hours upon successful completion of this training. The proposals were written to support the goals of the collaborative and will be funded directly through the college and university; however, the primary beneficiaries will be teachers in the Cleveland collaborative.

The Cleveland collaborative has served as a catalyst, supporting teachers to participate in activities that were not actually conducted by the collaborative itself. For example, the Teacher Advisory Board suggested a consumer mathematics course last year. The school district organized a committee of five teachers to work over the summer to develop a curriculum that would replace shop mathematics and senior mathematics in the schools. The course emphasizes real-life applications and computer usage and will be taught in grades 10 through 12 with general mathematics as a prerequisite. The formation of this committee under the leadership of Bill Bauer, the district's mathematics supervisor, is an example of the interactive relationship between the collaborative and the school district. Furthermore, the collaborative is helping to identify materials for the consumer mathematics course; among those materials being assembled is a videotape series. Most of the tapes will be obtained from the Public Broadcasting System through a joint effort of the collaborative and the school system, but local production of some videotapes also is planned. Curriculum development for the consumer mathematics course was aided substantially by the business and industry contacts established through the collaborative. C^2ME purchased a year's newspaper subscription for all classes of consumer math.

Another example of the collaborative's role as a catalyst is the MathCounts contest, now in its fourth year. This program is sponsored by Standard Oil, NASA, NCTM, National Society of Professional Engineers, CNA Insurance, and the U.S. Department of Education. Judges for the contest are supplied by John Carroll University and Baldwin-Wallace College. In 1985 the Cleveland Public Schools had two teams; in 1986, with collaborative support, the number of participating teams increased to twenty-four.

The Cleveland Education Fund submitted a proposal to the Carnegie Foundation to fund a science collaborative to complement the mathematics collaborative. When Bryan Powers was hired as the coordinator of C^2ME, it was assumed that he would become coordinator for the science collaborative as well. In November, Bill Bauer, the mathematics supervisor for the Cleveland School District; Bob Seitz, a high school mathematics teacher and the collaborative's on-site observer; and Dick Little, the chair of the Advisory Board, attended a Yale conference on educational collaboratives. Fred M. Hechinger, the president of the New York Times Co. Foundation, was keynote speaker. The Yale-New Haven Collaborative, a Carnegie-funded science collaborative, was experiencing funding problems due to the lack of a strong link with industry. Many questions were directed at the representatives from Cleveland, as the Cleveland mathematics collaborative is viewed as being quite successful in this regard.

E. Project Activities

During 1986, C^2ME offered a wide variety of activities designed to provide teachers with opportunities for training, information, collegiality and networking, with other teachers as well as with mathematicians from business, industry and higher education.

OUT-OF-SCHOOL ACTIVITIES

The goal of out-of-school activities is to provide enrichment opportunities for teachers in industrial and university settings, to provide opportunities for teachers to engage in independent learning in advanced mathematics, to increase teachers' understanding of current applications of mathematics, and to increase teacher collegiality.

Seminar in Advanced Technologies at Lorain County Community College

The third series of seminars in advanced technologies at Lorain County Community College was held April 1-4, 1986. (The first two seminar series had been held in April and June, 1985.) The five-day program was designed to broaden the experience of high school mathematics teachers through participation in a series of advanced technologies workshops. At the workshops, teachers were instructed in the basic concepts of new technologies and made aware of the integral part that mathematics plays in each.

In response to teacher suggestions after the first two seminar series, the April, 1986, seminars were modified so that the first session on basic computers was held in the IBM PC Executive Training Room, and focused on applications in problem solving using spread sheets, concepts in local area networking, and a survey of conceptually based mathematics software.

Sessions during the remaining four days were held at Lorain County Community College's Advanced Technologies Center. The seminars consisted of one half day (four hours) instruction in each of four courses: CAD/CAM, Statistical Process Control, Computer Numerical Control, and Robotics. Teachers spent the afternoons in small-group work on lesson planning; these sessions were designed to encourage teachers to think about ways to integrate the advanced technologies into the mathematics curriculum. Several afternoons at LCCC were supplemented by further discussion or the opportunity for hands-on experience with the advanced technologies.

Ten junior-high and high-school teachers participated in the April seminars. (There were twelve applicants for the ten positions.) Participating teachers received continuing education credits, tuition, mileage and lunch allowance, and a $100 stipend.

Teacher evaluations, completed at the end of each daily seminar, were extremely positive. In general, teachers evaluated the seminars as providing "excellent" instruction. Their comments included: "informative and extremely well planned"; "very interesting seminar and good discussion"; and "very practical." In general, most teachers believed that the programs were very applicable to the high school classroom; one exception was the seminar on Computer Aided Graphics and Design, which received a "satisfactory" rating in terms of applicability. The activity's success has triggered plans to repeat it.

Oberlin Problem-Solving Workshop

Six secondary school mathematics teachers received funding through the collaborative to attend a workshop in problem solving at the Oberlin Teacher's Academy from June 16 to June 28. The workshop was designed to sharpen teachers' skills, to help them build a problem-solving library, and to guide them in preparing a plan for classroom implementation. The seminars were taught by Dr. Rudd Crawford, a mathematics teacher at Oberlin High School and the director of the STELLA project in problem solving--a project for which he has received national recognition. Dr. Crawford is also half-time instructor at Oberlin College.

All of the participants felt the workshop was worthwhile and said they would apply what they had learned in their classrooms in the fall. The teachers also stressed the value of meeting and working with other mathematicians. One teacher said, "The activity was excellent; I would advise it for everyone. It should be mandatory for teachers who have not been in class for awhile." Other comments included: "I would like to see every Cleveland teacher exposed to this activity. I received an organizational framework for giving non-routine problems in a systematic fashion"; "The experience is a rich resource for future planning in the teaching of mathematics, for networking with other math teachers in the Cleveland Area and for future professional growth"; and "I think that the two-week workshop has been very helpful to me. It gives me something concrete to take back and try in the classroom. Our own problem-solving skills were increased also. The workshop really motivated me to do more with problem solving."

The collaborative paid the six teachers who attended the Oberlin workshop to spend two weeks organizing and further developing the problem-solving materials, and to plan two one-day workshops on problem solving for Cleveland mathematics teachers. These workshops were held in August.

Problem-Solving Inservice for Intermediate and Secondary Teachers

In August, the Cleveland Public Schools sponsored two one-day workshops on problem solving, to which all Cleveland mathematics teachers were invited. Fifty-eight of approximately eighty seventh- and eighth-grade teachers attended the August 25 workshop; seventy-nine of ninety-eight high school mathematics teachers attended the session on August 27. The workshops' main purposes were to promote problem solving, collegiality among teachers, and teacher awareness of programs and opportunities available to them.

During the morning sessions, Rudd Crawford of Oberlin College explained his problem-solving techniques and gave each teacher a box of fifty-one problems. In the afternoon, teachers received more material, applications to join professional organizations, and a summary of what is going to happen in the Cleveland schools in the near future. An overview of the collaborative and the activities it sponsors also was presented.

The teachers seemed quite impressed with the workshop. Many commented that it was the first time in many years that the district had paid attention to mathematics teachers, had given them a "big picture" of the curriculum or suggested specific equipment, or materials. Most of the evaluations were very good, with many teachers expressing an interest in more workshops. Comments included: "The session was very impressive, real needs were systematically satisfied. Materials are very useful and could only be acquired personally with many hours of effort. Congratulations"; "Forces me to do what I should do. Certainly worthwhile"; and "I liked receiving immediately usable materials, a lot of structure for the year. Very good kickoff for the new school year."

A make-up problem solving inservice was offered on October 9 to those teachers who were unable to attend the original inservice. Sixteen teachers attended.

Problem-Solving Workshop Series

Six weekend seminars similar to the Problem-Solving Summer Workshop are scheduled at Oberlin College during the 1986-1987 school year. The first session was offered October 3 and October 4, and the second was held October 31 and November 1. Each session included a Friday dinner meeting and a Saturday breakfast meeting. Fifteen teachers attended the first session; eleven teachers attended the second. The remaining four places were filled by teachers from neighboring districts. This mixing with colleagues from outside the local system appears to add an important dimension to the activity. Teachers selected to participate in the sessions wrote problems that have since been added to the bank of problems that was distributed at the August workshop.

Participants in the first workshop felt it was worthwhile, although some believed there was too much to do in the short time allotted. One teacher commented: "It was an opportunity to exchange ideas with other mathematics teachers. It was refreshing without being pressured on deadlines." Another observed: "The concept is worthwhile--developing a long-term project that people need help in. . . . I was rushed, should be longer than one weekend. . . . I expected more on 'techniques' of teaching problem solving!" After the second workshop, a teacher commented: ". . . I loved it because we worked together with other math teachers, had a nice time, did real mathematics... Teachers were confident, a step ahead because of our August workshop."

Baldwin Wallace Workshop

In October, thirteen intermediate school teachers were selected to attend workshops on the implementation of student-centered activities. The workshops were offered every Wednesday for ten weeks throughout the months of October, November and December. Included in the workshops were topics related to the incorporation of MathCounts into the curriculum. Dr. Richard Little, who is a professor of mathematics and computer science at Baldwin-Wallace College, a judge in the MathCounts contest, and president of the C^{2}ME Advisory Board planned the workshops in consultation with the Cleveland Public Schools supervisor of mathematics. Six teachers earned three hours of college credit for their participation.

It is anticipated that the teachers who attended the workshops will hold inservice training workshops for their colleagues on student-centered activities and career exploration.

Conference on Computers in Secondary School Mathematics

Two teachers from the collaborative were selected to attend a six-day conference on computers and secondary school mathematics. The conference, held at Phillips Exeter Academy in New Hampshire, focused on the impact and application of the computer on the curriculum. Funding for the teachers was provided by the Technical Assistance Project at the Education Development Center, Inc. After returning from the conference, one of the teachers held workshops for colleagues at the Mathematics Teachers resource center on the integration of computers into the high school mathematics curriculum. The other teacher works in the district's Computer Center, and has continued offering workshops involving issues and content relevant to the Exeter meeting. The teachers also will be involved in curriculum development with other teachers and the Cleveland Public Schools supervisor of mathematics.

Calculator Workshop

On September 13, an inservice workshop was held at the Hilton Inn for intermediate mathematics teachers to ensure that they are comfortable working with calculators and integrating them into the curriculum; it was the first systematic calculator curriculum to be introduced in the Cleveland Public Schools. Fifty-one intermediate teachers attended. C^{2}ME plans to assist in developing, disseminating, and implementing new units and activities developed as a result of the inservice training. These calculator activities will be integrated into intermediate and high school courses. A make-up workshop for those teachers who were unable to attend the initial workshop was held November 18.

The calculator project exemplifies C^{2}ME's creative funding techniques. The Cleveland Education Fund paid $5,000 for the calculator materials; the Cleveland Public Schools paid teachers for their attendance at the inservice training sessions; and the State of Ohio paid for three national trainers, a facility and refreshments.

Teacher Internships

The Cleveland Teacher's Internship Program was established in 1980 to provide teachers with hands-on experience involving the mathematics used daily in business and industry. The program organizes summer work placements for teachers in area businesses or industrial labs for which teachers receive a stipend. In the summer of 1985, C^{2}ME coordinated eleven placements in industry and, in a parallel effort, identified one internship at Cleveland State University. In the summer of 1986, seven teachers were placed in internships in industry, and one at Cleveland State University. While the original two-year internship plan anticipated a total of ten internships, C^{2}ME has generated eighteen internship placements during that period. Prior to C^{2}ME's efforts, only one Cleveland Public Schools mathematics teacher had been placed through CTIP.

The internship program generally lasts eight to nine weeks and include five or six seminars on Wednesday afternoons. (Teachers also have the option of enrolling for one to seven graduate credits at CSU.) First-year interns received $275 per week, while second-year interns earned $325 per week, regardless of grade level or subject matter. In addition to the company-sponsored "internship," and the seminars, interns also prepared a new learning project for their own classrooms. Many of the teachers participating in the 1986 programs had worked as interns at different industries in 1985. In questionnaires completed by five of seven teachers who participated in 1986, four of the five said they could integrate their work experience directly into their teaching or into the mathematics curriculum. All five of the teachers stated that they felt that curricular changes are needed if students are to meet the expectations of future employers.

Teacher Scholarships

As part of its commitment to C^2ME, John Carroll University's Department of Mathematics offered tuition scholarships to mathematics teachers in the Cleveland Public School System. These scholarships covered tuition for university mathematics courses in the spring, summer, and fall of 1986. Courses offered ranged from introductory calculus and statistics to graduate courses in the department's Master of Arts and Master of Science programs. Scholarships, awarded on a competitive basis by a department committee, were granted to two teachers in 1986.

The Marsha Holden Jennings Foundation awarded a scholarship to a Cleveland Public Schools mathematics teacher to attend a one-week workshop on problem solving held during the summer of 1986. The workshop was led by Dr. Johnny Hill of Miami University.

Small Grants Program

During the last two years fifteen small grants totalling $6,170.40 were awarded to secondary school mathematics teachers to fund mathematics pilot projects; eight grants were made during 1984-1985, and seven were awarded during the 1985-1986 school year. Prior to C^2ME's involvement, only one small grant had been awarded to a Cleveland Public School mathematics teacher. Several teachers who received small grants had prepared and submitted projects as a result of their experience in the advanced technology seminars at Lorain County Community College.

C^2ME has made a concerted effort to encourage teachers to apply for small grants. Two informational meetings for mathematics teachers were held to explain the "research and test" philosophy of the small grants program and the Small Grants Booklet was distributed to all mathematics teachers in September, 1986. This booklet lists the names, telephone numbers, and project descriptions of teachers who have received small grants.

The small grants program, in general, was well received by teachers. One teacher commented: "The small grants program allowed me to give my students the WHY of learning mathematics."

Professional Meetings

In December, 1985, a group of Cleveland Public School teachers attended the National Council of Teachers of Mathematics regional conference in Columbus. Bill Bauer, the mathematics supervisor for the Cleveland Public Schools, reported on the collaborative's activities, and Harriet Jakob, who was coordinator of the collaborative project, provided materials about the collaborative. The teachers felt that the meeting was valuable; one commented: "The meeting was well worth it, even though we got no support from the Board of Education. Many teachers are concerned about this lack of support by the Board and have been for years."

C^2ME has committed itself to increasing the attendance of Cleveland Public School secondary mathematics teachers at professional meetings, as the traditionally low attendance is considered an impediment to the professional renewal of teachers. The collaborative sponsored a display area at the fall meeting of the Greater Cleveland Council of Teachers of Mathematics (GCCTM). Staffed by secondary school mathematics teachers from Cleveland Public Schools, the display disseminated information and materials and promoted networking and collegiality in an effort to strengthen the link that exists between C^2ME and GCCTM.

IN-SCHOOL ACTIVITIES

In-school activities are designed to facilitate communication and collegiality among teachers, to eliminate barriers to professional collegiality, and to offer opportunities for intellectual stimulation and renewal.

Cleveland Mathematics Teachers Resource Center

The Cleveland Mathematics Teachers Resource Center opened October 1, 1985, at the Metro Campus of Cuyahoga Community College. Three Cleveland Public Schools mathematics teachers were hired to establish and staff the Resource Center. (Two of these three positions were restaffed at the beginning of the 1986-1987 school year to allow several teachers the opportunity to work at the Center).

The Center provides Cleveland Public Schools mathematics teachers with opportunities for training, collegiality and information to enhance their knowledge and expertise as teachers. The Center also serves as the hub of curriculum development, in-service training, and collection and distribution of materials. It provides consultation services and distributes a list of suggested materials to each department chair in order to encourage mathematics departments to obtain supplemental textbooks, supplies, and materials such as calculators to help teachers implement an activities-based approach to mathematics instruction. In addition, a calendar of Resource Center activities and relevant information about other mathematics events sponsored by higher education, business, and industry is compiled and distributed to all secondary school mathematics teachers in the Cleveland Public Schools. Packets of "teasers" and suggested classroom activities highlighting problem solving are compiled by Resource Center staff and distributed to teachers.

Throughout 1986, informative programs and workshops were offered at the Resource Center. Highlights included an informative talk in January by Dr. Mark Driscoll of the Technical Assistance Project at the Education Development Corporation. Dr. Driscoll spoke on services and materials available from the Education Development Center. In February, textbook publisher Scott-Foresman sponsored a "Mathematics Roundtable" dinner and discussion. David Williams, mathematics supervisor of the Philadelphia School District, spoke at the meeting. This activity, and a follow-up event at the Resource Center, was coordinated through the Cleveland Public Schools supervisor of mathematics in cooperation with the resource center staff. Twenty teachers attended the roundtable discussion.

On April 25, the Resource Center sponsored a "happy hour" at the Playdium. Teachers, members of the Advisory Board, and friends were invited to attend; fifteen teachers, representing nine schools, participated.

Between October 1, 1985, when the Resource Center opened, and May 1, 1986, eighty-two teachers have used the Center, representing 41 percent of the total 200 secondary school mathematics teachers. Of these teachers, ten to twenty represent a "core group" who visit the Center several times each month.

Evaluations of the quality and effectiveness of the Resource Center were obtained at Teacher Advisory Board meetings and through a questionnaire sent to all teachers in March, 1986. The evaluations indicated an overwhelmingly favorable response to the Resource Center and to the services and support it provides to teachers in the form of information dissemination, training, collegiality, and networking. Between September and December, 1985, eighty-five teachers took advantage of the Center's resources. During the same months in 1986, the number of persons using the Center increased to 225, clearly demonstrating that Cleveland teachers recognize the importance of the services the Resource Center provides.

Mathematics Contest

On Saturday, April 19, 1986, the Cleveland Public Schools was one of several hosts for the Greater Cleveland Council of Teachers of Mathematics seventh- and eighth-grade mathematics contest. It was the first year that the Cleveland Public Schools were permitted to open a school building for the contest. Twenty-nine teams entered from the Cleveland Public Schools, representsing the largest number of teams ever entered by Cleveland schools. Student participants represented six of the twenty-four intermediate schools. Because it is so difficult to secure a site for the contest, C^2ME will assist in sponsoring the event in the future.

NETWORKING ACTIVITIES

These activities are designed to increase opportunities for teachers to interact professionally with their peers in the schools, as well as in other mathematics-related occupations. Events are planned to provide time for teachers to share their experiences, to gain exposure to emerging applications of mathematics, and to learn about new approaches to mathematics instruction.

Symposia

Three dinner symposia were held between May, 1985, and January, 1986. The symposia were designed to meet two primary goals: (1) to provide teachers with a forum for dialogue and interaction with their peers and with representatives of business, industry, public institutions, and higher education; and (2) to provide teachers with insights into current and future mathematical applications and topics. Attendance at the dinner symposia was usually limited to sixty teachers, with additional slots available for Advisory Board members.

The first dinner symposium was held May 30 at the Sohio Research Center. Forty-seven mathematics teachers attended, as well as seventeen members of the Advisory Board. The second dinner symposium was held at the Eaton Manufacturing Services Center on November 12. Fifty-four mathematics and fourteen members of the Advisory Board attended. The third and final dinner symposium, held at the NASA Lewis Research Center January 15, featured three speakers who described NASA functions, including the advanced Turboprop Project, and the relevance of mathematics to such projects. Winners of a trivia game focused on space exploration received books and other NASA material. Participants also toured the wind tunnel, where a propeller was being tested, and the computer center, where computer graphics were demonstrated. Teachers received a materials packet to take back to their classrooms. Take-home materials had been incorporated into the final dinner symposia as a result of teachers' evaluations of the first two symposia. Fifty-two teachers and thirteen Advisory Board members attended, as well as a representative of the Education Development Center, Inc.

During the 1986-1987 school year, the collaborative will sponsor Higher Education and Business/Industry Symposia. On December 2, Case-Western Reserve University hosted an IBM-sponsored evening of mathematics for Cleveland mathematics teachers. The event started with a wine-and-cheese reception and discussions among teachers and university professors. Each participant then attended one of three small sessions: Mathematics in Business; Probabilities in Everyday Life; and a visit to the Center for Automation and Intelligent Systems Research, accompanied by a talk on Artificial Intelligence and Robotics. University professors, representatives from business, and teachers then attended a dinner, after which Dr. Philip Davis, professor of mathematics at Brown University, spoke on "Napoleon's Theorum: The Importance of Geometry," which emphasized the importance of the mathematics teacher as a motivator to students. The entire program was well received by the teachers.

The dinner symposia were among the most popular of C^2ME activities. Attendance at each symposium represented more than 25 percent of the total 200 Cleveland Public Schools secondary school mathematics teachers. Teacher evaluations suggested that a major factor in the symposia's success was that they provided an opportunity to "talk with colleagues." Other factors included the tours, the exposure to the uses of mathematics in business and industry, and the distribution of free materials.

After the symposium at NASA, teachers comments included: "The symposium provides a good opportunity to meet colleagues and to broaden knowledge of the specific facility being shown"; "I have a chance to talk to other mathematics teachers and to get actual applications of mathematical tools"; and "It is an excellent way for the teacher to keep up on what is going on in industry/business, and this in itself is useful, even if a particular area does not lend itself to immediate use in the classroom. Teachers with a wide knowledge of application can create their own materials appropriate to the level at which they are teaching."

C^2ME Newsletter

During the 1985-1986 school year, issues of the quarterly newsletter were distributed to teachers and Advisory Board members. The newsletter includes articles on C^2ME's goals, descriptions of programs and offerings to teachers, and recognition of teachers for their personal accomplishments and their participation in C^2ME activities. Bob Seitz, a Cleveland Public School mathematics teacher and the on-site observer for the collaborative, edits the newsletter.

Newsletter evaluations, distributed to teachers in March, indicate that response to the newsletter has been very favorable. Teachers have suggested that more articles detailing teaching tips, research in mathematics education, suggested classroom activities, and uses of mathematics in business and industry should be included in the newsletter.

F. Observations

The Cleveland Collaborative for Mathematics Education has continued to progress in 1986. Discussion of the collaborative's growth will focus on four major issues: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

Management of the project remains in the capable hands of Paula Anderson. In spite of the turnover in coordinators each year, the project has been able to progress with a rich and varied array of activities that have been well received by teachers. Three characteristics of the Cleveland collaborative seem to have allowed such steady progress, even in the face of major personnel changes: (1) the professional strength of the director, and her solid and enduring leadership; (2) the cooperative relationship with the supervisor of mathematics from the Cleveland Public Schools; and (3) the high priority placed on teacher involvement very early in the collaborative's development, so that a strong core of teachers have emerged. Together, the director, the mathematics supervisor and the teachers have maintained a strong vision that provides continuity.

In contrast to the situation faced by some of the other collaboratives, the preparation of the proposal for renewed funding was not a major problem. In fact, it provided C^2ME with an opportunity to assist Bill Bauer, the mathematics supervisor of the Cleveland Public Schools, in developing a more coherent long-range plan for the improvement of mathematics teaching in the secondary schools.

The formation of two advisory boards to assist C^2ME during the past year has been a positive step in the institutionalization of the collaborative. The Teacher Advisory Board promises to be a positive avenue for teacher input to the design and conduct of the project's programs.

Activities sponsored or supported by C^2ME have been rich and varied, and they have provided all teachers in the district an opportunity for professional development. However, as might be expected in an impoverished environment, some teachers have yet to become involved. A very active core group of teachers have organized, developed, and participated in, many of the activities; this enthusiastic core has expanded and the conviction and work of its members are beginning to overcome the hesitation of others.

COLLABORATION

The collaborative aspects of C^2ME have expanded during the past year. Strong support from business and industry, first demonstrated when the collaborative was initiated, has not diminished. Cooperation from higher education, initially lacking, is now beginning to emerge. Most important has been the evolution of a strong core of mathematics teachers who are starting to exert influence on the scope and direction of C^2ME. This trend is being encouraged and facilitated by the efforts of the district mathematics supervisor. One of the most interesting developments has been the creation of curricular materials by teachers drawing on considerable input from university and industrial mathematicians; for example, the development of problem-solving activity kits was supervised and assisted by Rudd Crawford from Oberlin. The development of a consumer mathematics course to replace Shop Math in the schools demonstrates the potential benefits of building collaborative relationships.

Long term school-district support for the activities of C^2ME is problematic, given the history and volatile nature of the politics and relationships between the School Board and the administration. Most teachers see these quarrels as having little impact on their everyday jobs. However, without positive leadership, there is an inescapable sense that new activities are on thin ice. Within this environment, the district's mathematics supervisor has been able to apply the collaborative's resources to support a wide array of activities. Nonetheless, he remains constrained by several bureaucratic conditions which, as yet, he is unwilling to challenge. For example, when asked at the August workshop on problem solving whether the district's competency tests would begin to include problem-solving items, he responded that it was not a good time to deal with that issue. With a new administration and Bauer's incremental approach to systematic changes in a highly bureaucratic district, it will be interesting to follow what happens in the next few years.

TEACHER PROFESSIONALISM

Teacher participation in collaborative activities has continued to increase. By December, 1986, more teachers had participated in collaborative activities during the fall semester than had participated in the entire 1985-1986 school year. Of the 186 targeted teachers, 143 teachers, or 76.9%, had participated in at least one collaborative event during the fall semester and fifty-three teachers, or 28.5%, had participated in at least three collaborative activities. It appears that teachers are beginning to recognize that the collaborative is here to stay.

There is no question that the core group of teachers who have actively participated in C^2ME during the past two years have gained a real sense of professionalism. These teachers are receiving are recognition and assuming responsibilities that they have never before experienced. For example, teachers were selected by math supervisor Bill Bauer to write midterm and final exams for all of the secondary mathematics courses. Twenty-three teachers met to review and to revise the pupil performance objectives and to work on developing the midterm exams. The completed exams will be distributed to each school for administration before the end of the fall semester. The committee also will write final exams for each subject (consumer math, intro. algebra, algebra I, geometry, algebra-trigonometry, advanced math, and calculus). Those exams will be administered at the end of the year. (It should also be noted that teachers were paid for six inservice hours.) In addition, twenty-eight teachers have piloted twelve new textbook series for Pre-algebra, Algebra II and Geometry. A committee of teachers will select the books to be purchased for the various courses. These processes have allowed teachers to provide input into the mathematics curriculum and to feel ownership of the mathematics program.

It appears that teachers are not the only participants being empowered as a result of the collaborative; the position of the school district's mathematics supervisor has been strengthened substantially through his association with the collaborative and as a result of its legitimacy outside the school district. In addition, the mathematics supervisor has discovered new ways of involving teachers, has realized the value of that involvement, and has developed creative ways of using inservice funds to enhance the professionalism of teachers.

For teachers who have not become involved, however, a "working-place mentality" still exists, as exhibited by their comments at the August workshop. Most initial questions addressed such topics as who was paying for parking and lunch. These teachers are accustomed to being treated as conduits in a system, as workers on an assembly line, and they expect to be regarded as such. For some, money becomes a way to strike back at a system that has treated them unprofessionally.

MATHEMATICS FOCUS

This collaborative's approach to mathematics, mathematics instruction, and its reform is rather eclectic. Calculator use, problem solving, and consumer math all are important aspects of the current reform movement in mathematics education. Participants in the collaboratives are beginning to expand their view of mathematics; for example, teachers are attempting to incorporate problem solving in the pupil-performance objectives in the curriculum. In some cases, this would involve reevaluating what is viewed as important in a subject. Teachers are advocating the use of such technologies as calculators and computers to enhance the teaching of mathematics skills. As calculators and computers come into classroom use, curricular changes become apparent (i.e., an increased emphasis on the uses of decimals and place value).

G. Next Steps

The collaborative recognizes that it must have vision in order to make a lasting impression. This vision would dictate the following:

1. the programs must form a coherent whole, building upon one another to address identified needs. For example, the Ohio State Pre-Algebra Demonstration Project will build on the skills and knowledge developed in the current calculator project.

2. Careful consideration must be given to continued financial support. Creative fundraising is the key. The collaborative will continue to look for ways to tap existing local, state, federal, and national funding.

3. Teacher support must be maintained and increased. A danger exists that teachers' energies will be spread so thin that programs will become ineffectual, and sufficient follow-up will not occur. Symposia must remain novel and stimulating, workshops must be highly applicable to the classroom, support must be forthcoming. The core group of teachers must be strengthened and expanded so that it becomes the teachers who are motivating the improvement. Strengthening the network between teachers will be a major step toward this end.

Several steps are being planned to encourage communication among teachers. First, C^{2}ME is creating the "Schoolhouse" on Free-Net, which is a free community-access bulletin board based on a representation of an entire electronic city. The "Schoolhouse" will include an information desk, school bulletin board, teacher's lounge, library, counselor's office, mathematics center, and C^{2}ME room. This facility will enable instantaneous communication between teachers in locations across the city. Communication among teachers also will be facilitated by in-house printing capability made possible by laser printer and software. Calendars will be produced less expensively and more quickly. Flyers will be produced readily to announce changes and new activities, and to serve as reminders. In all of these efforts, teachers will be working for teachers, so that power springs from within.

SUMMARY REPORT:
DURHAM COLLABORATIVE: THE DURHAM MATHEMATICS COUNCIL

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the Durham Mathematics Council. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Durham Mathematics Council to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco of representatives of all of the projects; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

DURHAM COLLABORATIVE: THE DURHAM MATHEMATICS COUNCIL

A. Purpose

The activities of this collaborative project over the next four years are to be guided by the five interrelated themes that were outlined in the proposal for refunding. These themes are:

1. The empowerment of teachers to determine the mathematics curriculum. The state of mathematics is rapidly changing, with a new emphasis on such topics as finite mathematics, statistics, and the application of the microcomputer. As technology continues to advance, the need to update the mathematics curriculum grows. The Council will encourage and support teachers in the development of new curricula and methodologies for teaching mathematics and will provide teachers with opportunities for professional growth and leadership, so that teachers will be in a better position to change curriculum. By bringing teachers together to work in this area, the Council will help them develop a stronger voice in future curriculum matters.

2. Involvement of teachers in decision making. Too often in the past, teachers have been passive agents in curriculum reform. Rather than part of the change, teachers have been the recipients of the change. If teachers are to develop into true professionals who have an impact on matters such as curriculum, they must become involved in the decision-making process. The best way to become a part of this process is to be recognized by the community as having expertise in a given area.

   In light of this, the Council will develop activities that aid teachers in acquiring the expertise and leadership potential needed to become a part of the decision-making process. The Council will concentrate on developing high visibility and support from all areas of the community.

3. The growth of the Council to eventually include teachers in the Research Triangle area. The Research Triangle area (Durham, Raleigh, Chapel Hill) is rich in resources and mathematicians. By striving to involve this entire area, the Council will grow in visibility and importance. With this growth will come the ability of teachers to make change happen.

4. Having an impact on curriculum at the state level. More and more basic curriculum matters are being decided at the state level. If the Council is to empower teachers to affect change and set the course of mathematics education,

it must focus its efforts at the state level as well. The Council will need to aid teachers in learning how they can become involved in state decision-making processes regarding such issues as curriculum, statewide testing, and textbook selection.

5. Development of a professional mathematics community. The Council's highest priority is ending the feelings of isolation and powerlessness experienced by mathematics teachers. The Council will strive to develop a truly professional mathematics community in Durham, composed of mathematicians from all areas. The Council will work to combat phrases such as "...just a teacher..." as well as to develop a base of community support in order to demonstrate the value that Durham places on mathematics and education.

Accomplishing the goals implicit in these themes is a very ambitious undertaking. The Council has identified four areas in which it must succeed in order for the collaborative to become institutionalized:

1. The development of a secure resource base. Over the next four years, the Council must develop strategies to secure a sound, stable financial base. If long-term goals are to be set, and if teachers are to be asked to make long-range commitments, then the Council must demonstrate its financial security.

2. The involvement of teachers in the decision-making process. Traditionally, teachers have not been involved in policy decisions. The Council must deal with the existing framework of decision-making policies in order to develop strategies that involve teachers in the decision-making process.

3. The development of a broad-based network. The Council must develop strategies to educate members of the mathematics community about ways they can and should work together. Traditionally, barriers have existed among people in the university community, business community, and public-school community. The Council must find ways to transcend these barriers and to demonstrate commonality of purpose among area mathematicians.

4. The establishment of ownership of the Durham Mathematics Council. The Council must strive to develop a sense of community ownership. In order to survive, the Council cannot be viewed as a Ford Foundation project, nor as a program of the North Carolina School of Science and Mathematics; it must be seen as a Durham project to improve education in Durham. The Council will need to focus on strategies to develop this sense of community ownership.

B. Context

Relative to the sites of other collaboratives, Durham is a small community with limited resources. This, in particular, has led to serious difficulty in raising funds.

This past year, the Durham County schools have seen a comprehensive reassignment of principals. A number of principal reassignments also occurred in the city district. Durham High (in the city district) was without a principal from June until October. A new assistant superintendent in charge of curriculum was appointed in the city district. He has shown a positive interest in the objectives of the Mathematics Council.

The county school district has decided to adopt a K-5, 6-8, 9-12 structure within the next three years. This will involve a complete reorganization of the administrative staff, as well as the construction of new schools.

The State of North Carolina appears to be heavily involved in education. For example, the state is currently working toward the establishment of a system under which all teachers would be required to follow a standard format in classroom performance. A career-ladder program may be implemented which would incorporate this standardized approach to classroom teaching. The state also established a state-wide textbook review committee; as a result of this committee's concern that discussion among teachers might bias them against some books, a summer workshop for Durham teachers to consider textbooks for adoption was cancelled.

All teachers in the Durham County System are being required to take effective teacher training this year or next year. This will involve attendance at ten three-hour sessions held from 3:00-6:00 p.m. or 7:00-10:00 p.m.

C. Development of the Collaborative

In contrast with many of the other collaboratives, there has been no change in either the management staff or the basic organizational structure of the Durham Mathematics Council.

The project director of the Durham Mathematics Council is Dr. Keith Brown, Dean of Special Programs and Research of the North Carolina School of Science and Mathematics. The executive director of the collaborative is Dr. Jo Ann Lutz. Dr. Lutz, who has a half-time appointment as director, also teaches mathematics at the North Carolina School of Science and Mathematics. The on-site observer is Betty Peck, a mathematics teacher in the county schools.

Preparation of the refunding proposal proved very difficult for the Council. Given the size of Durham, especially in comparison to some of the other sites in which collaboratives are located, as well as the project administration's relative inexperience in fundraising, it is not surprising that the collaborative faced a serious problem in securing commitments for the required matching funds. The Durham Mathematics Council administration, however, now realizes the need for long-term planning in order to secure necessary funds.

The Durham Math Council has established a board of directors and a steering committee. The board of directors is comprised of fifteen representatives from area businesses, higher education, and the city and county school districts, including two teachers. The board oversees the functioning of the collaborative. Five standing committees were formed in September, 1986, to aid in administering the affairs of the collaborative: the Executive Committee, the Nominating Committee, the Finance Committee, the Advisory Committee, and the Public Relations Committee.

The Steering Committee, which was initiated in 1985 and meets monthly, continues to play an important role in the collaborative. One teacher from each school serves on the committee; these teachers were "self-selected" in that they were the first to return the questionnaire with a positive response. The Steering Committee channels input to the director from the teachers. Committee members also persuade other teachers in their schools to become active in Council activities. An added benefit of Steering Committee membership is that teachers who serve on it have formed a strong bond.

D. Relationship with Other Local Initiatives

The Durham Mathematics Council operates out of the North Carolina School of Science and Mathematics (NCSSM), a state-funded residential high school for academically gifted secondary students. It is staffed with exceptional mathematics teachers.

The Mathematics Department of NCSSM has a Carnegie Corporation grant to design a course to replace precalculus in the curriculum. The new course will try to meet the needs of more mathematics students by exposing them to some new areas of mathematics while retaining the essential elements of precalculus for students who will take calculus. The activities of the mathematics staff of NCSSM provide special opportunities for teachers in the Durham Math Council to be exposed to new ideas and to learn more mathematics.

E. Project Activities

The activities of the Durham Mathematics Council can be classified into two major components: those sponsored by the Council and those supported by the Council.

COUNCIL-SPONSORED ACTIVITIES

During 1985-1986, the Council sponsored several types of activities, all of which were designed to provide teachers with growth experiences. These activities originally were conceived as a "wish list" of projects developed through meetings with teachers during the planning phase of the proposal to establish the Council. Only those activities in which teachers have expressed an interest have materialized. In general, the activities were of four types: receptions, industry tours, seminars and workshops, and internships. The Council also produces a newsletter, which is an important vehicle for disseminating information.

Receptions

In September, 1985, the Durham Mathematics Council hosted a reception for all mathematics teachers in the city and county. Similarly, a reception was held in May, 1986, to celebrate the Council's success during its first school year of operation. A third reception was held on December 9, 1986, to highlight the Council's fall activities. These social events provide an informal setting in which teachers and mathematicians from supporting institutions can meet and socialize. They also provide a forum for disseminating information about the Council.

Invitations to the May reception held at the Sheraton University Center, were sent to all the mathematics teachers in the city and in the county; School Board members; the Council Board of Directors; principals; superintendents; mathematicians from local colleges and universities; and local politicians. Several scheduling conflicts (including the Teacher-of-the-Year Banquet and School-Award Night) meant attendance was sparser than expected. Nevertheless, teachers perceived both the event and the first year of the collaborative as very successful. One teacher noted: "It has been a very successful year from my viewpoint. I've had many opportunities that would never have been available to me without Durham Math Council." The representatives from various sponsoring industries also seemed optimistic about the first year of the collaborative effort. Howard Clement responded: "I am pleased with program--I feel it is excellent. I am impressed with quality of teachers." The representative from Blue Cross-Blue Shield commented: "I am enthusiastic about DMC. I plan to continue support." A representative from Duke Power stated: "I am very pleased with the reaction and response of members to Duke Power's programs. We plan continued and expanded support."

The third DMC Reception was held from 4:00 to 6:00 p.m. December 9 at Glaxo, Inc. at the Resource Triangle Park. All members of the Council, including mathematicians from industry and college professors, were invited. Dr. Miriam Leiva, chair of the Department of Education and professor of mathematics at Davidson College, gave a speech entitled "For the Love of Mathematics." Her presentation detailed topics she uses to arouse the curiosity and spark the imagination of mathematics students. After the lecture, a reception sponsored by Glaxo was held. Seventy teachers and industry representatives attended. One teacher said, "Dr. Leiva reinforced my feeling that effective teaching is what I make it, not a checklist of procedures." Another expressed pleasure at the "opportunity to meet with people other than math teachers--let's have more events like this." Dr. Leiva noted that she was "pleased by the enthusiasm of this group," and that she would "like to see other areas with like organizations." Dr. Imogene McCanless of Glaxo, Inc., a member of the DMC Board of Directors, said, "I would have liked to have a math Council when I was teaching."

Industry Tours

The Council plans to sponsor several day-long programs to show teachers the work being done by area companies. Two such tours were held in March, 1986.

General Telephone of the South. On March 11, 1986, a tour and seminar were held at General Telephone of the South. The six-hour session included lunch with company representatives. The purpose of the activity was to inform teachers as to the use of mathematics in the telephone communications industry, and to encourage teachers to broaden understanding of the type of mathematics students need. The seminar covered the basics of public and private integrated digital-switching systems and discussed future enhancements that will dramatically change the telephone system as we know it today. The tour highlighted telephone-company equipment in operation in order to provide a perspective on how the application of mathematical theory translates into the manufacturing of telecommunications products. Engineers from GTE were available to answer questions.

Twenty-one city and county teachers participated in the seminar and tour. The overall reaction to the day was quite positive. All the teachers interviewed seemed to feel that the activity was very worthwhile, although some teachers did feel that at times the information was too technical and did not contain enough "practical" mathematical applications for the classroom.

One teacher commented: "The activity was very worthwhile--it related mathematics to several phases of the phone industry." Another said, "Excellent presentation--they did not talk down to audience. I can tell my students how mathematics is used in industry." The representatives of GTE seemed to be favorably impressed by the teachers and indicated that they too enjoyed the seminar.

Duke Power Company. A day-long tour of Duke Power Company's Physical Sciences Building, the Nuclear Training Facility, and the Explorium was conducted March 27. All Council members were invited, with only the first ten applicants guaranteed acceptance. Nine teachers actually participated.

The primary purpose of the activity was to increase teacher awareness of the mathematical needs of potential employees. The day's activities included a tour of the nuclear facility, observation of computer use, and a review of the mini math course that is taught to new employees.

The teachers who participated in the day-long activity found it very worthwhile. One teacher commented: "Realistic needs for our students were outlined. Helps us know what to stress." Other comments included: "It showed the need for computer literacy and improved math skills"; "Gave us real applications of what we teach to take back to students." Several of the teachers said that the Council should offer the site visit again so that other teachers could go. One teacher added, "More of this type of tour at other businesses would be great!"

The hosting company, Duke Power Company, also seemed to find the activity rewarding. The personnel director commented on the quality of interest and the questions asked.

Seminars and Workshops

During 1986, the Council sponsored a variety of seminars and workshops. In general, workshops aimed at improving specific teaching skills and at providing teachers with activities they could take directly into the classroom.

1985-1986 Seminar Series. During the 1985-1986 school year, the Council, in cooperation with supporting industries, sponsored a series of four seminars on the applications of mathematics to business research. The first two seminars were held in 1985 and are described in the report for that year (Romberg & Pitman, 1985). The first seminar in 1986 (the third in the series) was at Liggett & Myers Tobacco Company on January 9. Clifford Rice, director of Materials Management, discussed the principles and techniques involved in managing inventories of materials, supplies and finished goods in a consumer products manufacturing company. The seminar was videotaped, with the intent of making the videotape available to teachers for use in the classroom. A reception preceded the seminar, providing the twelve participating teachers with an opportunity to interact with each other and with other mathematicians in the field.

The fourth seminar in the series was held February 18 at the North Carolina School of Science and Mathematics. It was attended by twenty-seven junior- and senior-high city and county mathematics teachers. The seminar, "Preparing Students for Math Contests," was presented by John Goebel, a teacher at the NCSSM who is widely recognized for his success in that area. The seminar addressed contest formats, preparation strategies and motivation techniques. Participants appeared to have found the seminar very worthwhile. One teacher commented, "I felt the seminar was beneficial both from the advice given on getting students to be more involved, to sources of information available for practice. I think hearing John's enthusiasm for the contests is good for all of us." Another teacher responded: "An excellent presentation. Brought home to me the importance of shifting the students' natural competitive instincts from purely athletics to an area which is far more worthwhile. I am excited about the potential this vehicle has for improving student interest in and enjoyment of academics." A third teacher said, "I think this was a good session. It has me more motivated to push and work my students in these contests. It also gave me ideas of what I might do in my own classroom."

Algebra II/Precalculus Network. On April 10, the first in a series of seminars and workshops on teaching mathematics at the algebra II level and above was held after regular school hours. This series, called the Algebra II/Precalculus Network, is designed to bring together teachers of Algebra II, Algebra III, Precalculus and Calculus to share ideas and help one another with problems.

At the first session, Helen Compton and Dot Doyle of the North Carolina School of Science and Mathematics demonstrated how they used computers in the classroom to teach topics on data analysis and matrices. Fifteen city and county teachers attended this first workshop and all found it extremely beneficial. One teacher commented: "This meeting of the minds is long overdue."

In September, 1986, a meeting was held to plan the program for the Algebra II/Precalculus Network for the 1986-1987 school year. Although a representative from each school was invited, scheduling conflicts resulted in only six teachers attending. The seminars will be open to all teachers, but meeting notices are sent only to those who inform the Council office of their interest. The meetings are held at 3:45 p.m. on the third Tuesday of each month at the North Carolina School of Science and Mathematics.

The first seminar of the Algebra II/Precalculus Network for the 1986-1987 school year was held October 11. Pat Robbins demonstrated software for the Apple. Programs included a question bank for algebra and trigonometry, and graphing programs. Five teachers attended. It was anticipated that the attendance would be higher, but many teachers were in meetings for a reevaluation project in which their schools were participating. All the teachers who participated found the activity to be extremely worthwhile. One teacher said, "As a first year teacher, I learned a lot about much software I had never heard of." Another said, "Hands-on use of materials was very valuable." A third commented, "We were able to use programs others had tested and found useful." The teachers appreciated being given copies of the programs that had been demonstrated.

The Algebra II/Precalculus Network met again on November 18. Dan Teague demonstrated MuMath, a computer program that does much of what is taught in the algebra curriculum. The demonstration was intended to stimulate discussion about the influence institutional software has on what (and how) content is taught in courses leading to and including Calculus. The fifteen teachers who attended the seminar seemed to feel that the seminar was very good. One teacher commented: "[The seminar was] interesting and thought provoking. Good discussion." Another said, "I was persuaded to at least open my mind to new possibilities. I see this coming, I hope that I'm prepared. At least I won't have too many old habits that will have to die hard."

Geometry Network. A series of seminars and workshops addressing issues and techniques related to the teaching of geometry was also scheduled for the 1986-1987 school year. The first meeting of the Geometry Network was held October 1. Vivian Leeper Ford gave a presentation on the Geometric Supposer at the North Carolina School of Science and Mathematics. The activity was intended to introduce teachers to the Geometric Supposer, to provide training in its use, and to allow teachers to experiment with it. A videotape on using the program was shown, followed by teachers' hands-on use of the Geometric Supposer.

The fifteen teachers who attended appeared to have enjoyed the program. The on-site observer reported that there was "great enthusiasm on the part of those who were there. One teacher commented, "The film was brief and to the point, informative, and a good introduction to the Geometric Supposer. We were allowed 'hands on' use of the software." Another responded, "[I] learned a lot about something new and useful." Other teachers commented, "I would like to be able to borrow the materials to experiment with some students"; "The activity was adequately explained and [it] showed the utility of the program. More examples of the different types of areas of usefulness would be helpful; more time on the demonstrations." A volunteer lay person commented, "Excellent program, interesting materials; probably a good beginning for what can be done in the future for geometry by using computers." The county math supervisor said "The series appears to be based on 'Discover Teaching,' which I have always found to be very helpful in helping students to become more knowledgeable once they have mastered the techniques involved. Should be an excellent addition to any program using the areas covered by the Supposer."

It was observed that some of the attendees stayed past adjournment to "play" with the materials.

Math for Grades 6 through 9 Network. On December 6, a seminar on the "Math Counts" program was offered at the North Carolina School of Science and Mathematics. John Goebel, a teacher at NCSSM who has helped to develop national-level Mathcounts tests, talked about this year's special topic, functions, and shared his ideas on how to teach the concept of function to seventh and eighth graders.

All junior high mathematics teachers were invited, but due largely to conflicts with the reception for cooperating and student teachers at the University of North Carolina-Chapel HIll, only nine teachers attended. One teacher stated that it was an "excellent background for introducing junior high [students] to functions." Another said, "It's so nice to see energy and enthusiasm."

Seminar on Statistics and Applications. On April 30, 1986, a full-day program focusing on statistics and survey research was offered by the Research Triangle Institute to teachers in the Durham Mathematics Council. Topics included field interviewing; Agent Orange; computer-assisted telephone interviewing; survey usage from design to analysis; the use of computers in surveys; and basic variability.

All members of the collaborative were invited, and twenty-one attended. The participants were very enthusiastic about the conference. One teacher commented, "Speakers were very knowledgeable and interesting--related talks to surveys which would be of interest to the general population. Used many examples of applied math usage. Would be good if these speakers were available to talk to small groups of math students or math labs."

Other teachers responded, "Excellent exposure in various possible job opportunities," and "Need more activities like this."

Blue Cross/Blue Shield. On January 27, 1986, Blue Cross/Blue Shield of North Carolina sponsored a day-long conference for selected secondary mathematics teachers. The conference featured programs on health economics research, actuarial and underwriting activities, and information systems. Lunch and a tour of the service center were included.

To apply for the conference, a teacher was required to complete a Professional Development Plan; teachers were then selected on a competitive basis. Twenty-eight city and county teachers attended.

Family Math Workshop. Later in this report, it is noted that in January, 1986, three teachers received grants to attend the Family Math Program in Berkeley, California. These three teachers presented a workshop on April 17, 1986, to share ideas and information with the Durham Junior High and Middle School teachers, in the hopes of interesting middle school teachers in involving parents in their child's mathematics education. While all five teachers present enjoyed the workshop and supported the idea, they were not sure that they could actually make "Family Math" work.

Workshop on Probability and Statistics. This two-day workshop at the North Carolina School of Science and Mathematics was held June 11 and 12. It focused on topics to be used in the classroom or in helping students with research projects. The morning sessions on materials for classroom use were presented by NCSSM teachers. The afternoon sessions were presented by Dr. Deborah V. Dawson, Assistant Professor of Biometry and Medical Informatics in the Department of Community and Family Medicine at Duke University Medical Center.

Thirty-seven teachers attended the conference, and they were uniformally enthusiastic about the program. One teacher commented, "The activity was certainly worthwhile. Gave knowledge we can use in classroom." Another said, "Super handouts--great problems--great notes. Can't think of anything we've done that I enjoyed more." Dr. Dawson also felt that the activity was very successful and said she "was impressed with the caliber of participants--their questions and interest."

Duke Power - Mini-Sessions. The January issue of the DMC Newsletter announced that the Duke Power Company had offered to provide teachers with two-hour mini-sessions on the uses of applied mathematics. The sessions are limited to a maximum of three participants to allow ample opportunity to learn and question. The DMC office coordinates the sessions and teachers may attend as often as they like. The topics are: (1) Business office; (2) Engineering, Construction, Operations; and (3) Marketing. To date, two groups of teachers have participated in this activity.

Internships

This year the Council initiated a summer internship program; through the program the Council secures summer insternships from area industries and matches teachers who possess the requisite skills or interests. Teacher participants receive financial support as well as an opportunity to use their mathematical skills. During summer, 1986, the Council coordinated an internship at Central Carolina Bank for one month, and another at the Triangle Universities Computer Center. This latter placement turned out to be more clerical than was expected.

The rate at which internships have been established has not been as rapid as was anticipated. While there is considerable interest among teachers in the opportunity to work at mathematics outside the school, this enthusiasm has not been matched by the corporate sector.

Information Dissemination

A primary tool for information dissemination is the Durham Mathematics Council Newsletter, published approximately every two months by the Council office and distributed to every secondary, middle school, and junior high teacher in the city and county school systems. The newsletter is comprehensive and provides such information as highlights of upcoming activities, reports from DMC members (including teachers who have attended conferences) and a report from the executive director of the Council. The newsletter is sent to each teacher's home address.

COUNCIL-SUPPORTED ACTIVITIES

In addition to the various activities that the Council sponsors, it helps provide funds to allow teachers to attend activities that are offered by outside agencies. These activities typically involve workshops and conferences, state and national professional meetings and grants. The rationale for providing funds is that these activities are instrumental to teachers' professional growth. Teachers are encouraged to find ways to share what they learn through Council-sponsored activities.

In 1986, the Council supported teacher attendance at a variety of workshops and conferences.

Workshops and Conferences

Family Math. In January, 1986, the Council provided funds to three teachers to attend a Family Math Instructors Training Workshop at the Lawrence Hall of Science in Berkeley, California. Family Math is a project of the EQUALS program that helps parents to become involved in their children's mathematics education. The teachers who attended the Family Math Program were very enthusiastic about it. One teacher commented: "Family Math confirmed my strong prejudice that everyone can do math in spite of the prevailing myth that some people are good at it and others are not. Using manipulatives, the Family Math staff at Berkeley's Lawrence Hall of Science kept up a fast, but friendly pace of mathematics activities designed for kids of 5 to 13 years and their parents and guardians of any age. The goal was not simply to get answers to the interesting questions and activities; we were encouraged to analyze our procedures and tactics. It was the most user-friendly group of participants and instructors I have ever encountered!"

The three teachers who attended are now conducting workshops for other teachers and parents. They have organized Family Math programs at their schools, inviting parents and children to come to school one evening a week to work on hands-on mathematics activities. They also gave a workshop on the subject at the North Carolina Council of Teachers of Mathematics Conference in Raleigh October 17.

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy. In June, 1986, five city and county teachers received support to attend this six-day conference on computers and secondary school mathematics. Three of the teachers received funds from the Council, and two from the Technical Assistance Project at the Education Development Center. The conference, held at Phillips Exeter Academy in New Hampshire, focused on the impact and application of the computer on the curriculum. One teacher who attended commented: "The Exeter Conference was terrific. It was well-planned and well-organized. The facilities were beyond my imagination. This was truly a delightful week of learning and fun." Teachers who participated in the conference will lead seminars during the year in which they will share ideas from the conference with other Durham teachers.

EQUALS in Computer Technology. In August, the Durham Mathematics Council awarded grants to four teachers to attend a five-day program sponsored by the University of California-Berkeley. The program is designed for teachers, counselors, and administrators serving grades K-12, but focuses on attracting and retaining women and minority students in computer education. The program is for both the beginning and the experienced computer user.

All four teachers who attended (three females and one male) felt that the activity was very worthwhile and that it had "great value for those who use and maintain computers." One teacher said, "I have had the opportunity to attend several workshops. . . . I must admit that I have never participated in one so challenging, inspiring, applicable, and interesting as the EQUALS workshop. It was well-planned and well-presented. We were presented with a model team-teaching situation and learned so much in so little time, it was remarkable!" The four teachers currently are planning ways to share what they have learned with other Durham teachers.

Logo Workshop. The DMC sponsored one teacher's attendance at a two-week course at the University of North Carolina on the uses of Logo.

Professional Meetings

NCTM Annual Meeting. In April, the Council sponsored five teachers' attendance at the annual meeting of the National Council of Teachers of Mathematics in Washington, D.C. The teachers, who would not otherwise have had the opportunity to attend the meetings, received funds for both travel and expenses. Each teacher was also granted release time by the school district as the district's contribution to the Council. All four teachers were unanimous in their praise for and appreciation of the conference.

NCCTM Meeting (October 17-18). The NCCTM meeting was held in Raleigh, North Carolina. The Mathematics Council did not need to alternate funds to teachers for this meeting since Raleigh is only 20 miles from Durham. Furthermore, the Friday of the meeting coincided with a scheduled workday of release time for teachers of both districts. At the NCCTM meeting, the three teachers who had received funds to attend the Family Math Workshop at the Lawrence Hall of Science in Berkeley, California gave a workshop on Family Math.

NCTM Southeastern Regional Conference (November 13-15). Four teachers from both city and county schools received stipends to attend the regional conference in Charleston, South Carolina.

Grants

Small Grants Program. The small Grants Program supports innovative efforts to enrich and strengthen mathematics curriculum and provides seed money for instructional experimentation and equipment. The Council has informed teachers that curriculum grants of up to $300 are available to develop or purchase classroom materials. Grant applications are reviewed by the Advisory Board of the Durham Mathematics Council. The fall issue of the Council newsletter described the Small Grants program, and included an application form. During 1986, the Council received one successful mini-grant proposal which enabled a teacher to attend a two-day mathematics education conference in Greensboro.

Study Grants. The Council also offers grants for university study in order to provide mathematics teachers with the opportunity to pursue advanced study in mathematics. The Council will provide teachers with a stipend that will pay tuition, fees, books, and/or release time from one class. As of August, 1986, four teachers had been awarded grants for university study.

F. Observations

The Durham Mathematics Council has progressed in several areas of primary interest to the Urban Mathematics Collaborative project. These areas include: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

During 1986, the management of the Durham Mathematics Council continued in the capable hands of Keith Brown and Jo Ann Lutz. The only management problem experienced during the year related to preparation of the refunding proposal. The business representative who was responsible for fundraising failed to do the job, leaving Keith Brown and especially Jo Ann Lutz with that responsibility. Even with a tardy start and a somewhat hurried effort, they were able to secure sufficient matching funds. The Durham Chamber of Commerce proved to be very helpful in this emergency situation. Future restructuring of the fundraising effort is reflected in the refunding proposal.

Development of the refunding proposal provided an opportunity for the Council to propose a shift in its strategy for helping mathematics teachers. During the initial phase of the collaborative, a menu (or wish list) had been prepared. When teachers expressed interest in a menu item, the Council either sponsored an event or supported Durham teachers' participation in events conducted by others. This strategy proved of considerable value in counteracting teachers' sense of isolation from each other and from the issues and problems of mathematics and mathematics education. However, a shift in strategy is now being implemented. While continuing to sponsor and support a variety of activities, the Council will focus its efforts on three issues:

1. the development of new topics for the fourth year of mathematics;
2. the integration of technology into the classroom; and
3. the application and transferability of mathematics.

Program activities that focus on these issues must receive positive response from teachers, must be flexible and innovative, and must be broad based enough to encompass a range of mathematics teachers. It will be interesting to follow the development of these focused activities and their impact on mathematics teaching over the next several years.

Another proposed development is the establishment of the Triangle Mathematics Club, a professional mathematics organization that would include teachers from areas outside of Durham. Teachers appear to be recognizing that the absence of a local professional organization has been an inhibitor to their professional growth. A professional mathematics organization could become an affiliate of NCTM and may involve mathematicians from all sectors. An organizational meeting was held December 2, 1986 at the North Carolina School of Science and Mathematics. All high schools but one were represented. Those in attendance agreed that the Triangle Math Club was a good idea, that the Council should help get the organization started, and that the club should sponsor dinner meetings with good speakers.

COLLABORATION

The strength of the Durham Mathematics Council stems from two sources: the support from the "high tech" industries in the area, and the mathematical and educational background of the staff of the North Carolina School for Science and Mathematics. The teachers are knowledgeable and current on the issues related to school mathematics, and they are active in dealing with those issues. At the same time, they are classroom teachers who deal every day with high school students. The Council will continue to build upon these strengths.

To date, the Council has involved mathematicians from industry and higher education by inviting them to present or to share ideas with teachers; these industrial activities have been well received. The Council has been less successful, however, in involving university mathematicians. The establishment of the Triangle Mathematics Club could be an important step in building collegial relationships.

It must be noted that there have been no problems with the administrative staffs in both school districts. As the focus of the Council shifts to curricular changes in the next two years, it will be interesting to note the support and the impediments that may emerge. This is of particular importance in light of North Carolina's approach to effective teaching and assessment. Efforts to meet the state's demands could influence the perceived needs of teachers, and hence the character of Council activities, especially as teacher input increases.

TEACHER PROFESSIONALISM

Although not unionized, there is a very strong "work place" mentality among the teachers served by this collaborative. Furthermore, due to the lack of a local professional organization, mathematics teachers were very isolated from one another and from the issues and trends in the field. That has begun to change for many of the teachers who have participated in several collaborative events. However, a large number of teachers in the area have yet to take part in Council activities. It should be noted that an initial differential in involvement between county and city teachers is disappearing. A core group of participants is emerging; they will be used to draw in those less involved.

In the fall, Jo Ann Lutz, the coordinator of the Durham Mathematics Council, and her secretary, visited each school to talk with teachers to generate support and enthusiasm for the Council. The response from Dr. Lutz and from the teachers she visited was overwhelmingly positive. Perhaps this "personal touch" will stimulate greater participation.

The need for a Math Council secretary extends beyond the organization's administrative or clerical requirements; the fact that the phone is always answered has proven to be of great importance in building contacts with teachers.

The Council's activities to date exhibit an interesting mix of paternalistic events offered by outsiders and a "choice" mechanism which allows teachers to select from a menu those activities in which they wish to participate. The expectation is that this strategy will nurture the development and maturation of a truly professional group of mathematics teachers.

There is some concern that teacher participation in future Council activities may decrease due to the implementation of new school programs in the 1986-1987 school year. All county teachers will be required to take "Effective Teacher Training" in 1986-1987 or in 1987-1988; as noted earlier, this will require attendance at ten three-hour sessions after school hours. In addition three schools will conduct self-evaluation and reevaluation studies for Southern Association. It is feared that this effort will be extraordinarily time consuming. Many Durham teachers do not want to miss classes to attend Council activities held during school hours; additional commitments during after-school hours may therefore impact on attendance at Council activities. This possibility must be monitored carefully.

MATHEMATICS FOCUS

The Durham Mathematics Council's refunding proposal clearly addresses the need to change the current mathematics curriculum. As discussed earlier, the Council proposes three themes for this work over the next two years; these reflect this need.

G. Next Steps

The collaborative will continue to offer teachers the opportunity to participate in industry tours, seminars, conferences, and workshops, and will ask the participants to report back to their colleagues about their experiences. For example, the teachers who attended the EQUALS program at Berkeley during the summer, 1986, will present a day-long workshop.

The Research Triangle Institute (RTI) will again offer a day-long seminar for teachers, as it did in spring, 1986. The seminar will focus on the use of mathematics and computers at RTI. Four departments are planning presentations, including: "Mathematics in the Development of Disease Transmission Models"; "Random Digit Dialing Survey Methods"; "Silicon Chips and the Mathematics of Image Analysis"; and "Computer Graphics: Modeling Real-Time Processes." In addition, several dinner meetings will be scheduled. These meetings will feature an invited speaker who will discuss relevant topics in mathematics and mathematics education. These meetings also will provide a forum for teachers to present results of their projects. The Council is also beginning to explore the use of cable television as a means of serving the entire mathematics community.

The Council also will make funds available for teachers to visit schools with model programs. As in 1986, grants of up to $300 will be offered to teachers for classroom improvement. The Study Grant Program, which encourages teachers to pursue university study, also will be continued.

During 1987, a limited number of new grants will be awarded to cover the costs of up to one month of summer work in an area related to Council goals. These grants will be awarded on a competitive basis, with special consideration to projects aimed at traditionally underrepresented groups. Teachers also will have an opportunity to apply for grants for model programs; this support will include endorsement of the project, and funding for teacher training and materials.

As discussed earlier, the Triangle Mathematics Club will be organized to involve mathematicians from all sectors and to promote the growth of mathematics and mathematics education. It is envisioned that the club will become self-sufficient with elected officers and regular meetings. Given the number of mathematics teachers in the Triangle area, the need to offer professional experiences to teachers outside of the Durham area has been discussed. The establishment of the Triangle Mathematics Club is a good first step, since the mathematics club will include teachers from outside of Durham.

The Math Council is in the process of establishing a teacher Resource Center. The center will include a test bank organized by teachers, textbooks for review, and computers and software to try. The DMC Resource Center is being located at NCSSM, next to the Math Council Office. Teachers are being encouraged to help organize the center.

In June, 1988, the Durham Mathematics Council and the North Carolina School of Science and Mathematics will host a national mathematics conference on the theme "Trend in Mathematics Education." Experts from across the nation will be invited to speak. Topics will include changes in curriculum, trends in textbooks, the state of the mathematics teaching force, and trends in technology.

SUMMARY REPORT
LOS ANGELES URBAN MATHEMATICS/SCIENCE COLLABORATIVE (LAUM/SC)

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the Los Angeles Urban Mathematics/Science Collaborative. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Los Angeles Mathematics/Science Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco of representatives of all of the projects; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

LOS ANGELES URBAN MATHEMATICS/SCIENCE COLLABORATIVE (LAUM/SC)

A. Purpose

The Los Angeles Urban Mathematics/Science Collaborative is the official title of the thirty-five-member Advisory Committee to the Los Angeles Educational Partnership. This committee, created in 1986, is comprised of the advisory committees of the Los Angeles Urban Mathematics and of the Math/Science Fellowship. The Advisory Committee advises the Los Angeles Educational Partnership on the operation of four programs: +PLUS+ (Professional Links with Urban Schools), Math/Science Teacher Fellowships, Science and Math Enrichment, and Target Science. Restructuring the Advisory Committee resulted in expanding the Los Angeles Urban Mathematics Collaborative to incorporate science.

The goal of the Los Angeles Urban Mathematics/Science Collaborative is to use a mathematics resource network to assist teachers in relating the world of work to the mathematics curriculum. It is expected that teachers will benefit from expanded horizons and increased interaction with colleagues. Collaborative objectives for 1986 involved an expansion of those cited in the original funding proposal: networking and collaboration among teachers, mathematics departments, and mathematics resources were expanded from the community level to encompass state and national resources; team building and leadership skills for mathematics teachers were further developed; teachers were provided opportunities to develop, evaluate, and integrate new materials and methods into the curriculum.

It is anticipated that LAUM/SC activities will enable teachers to:

1. become a part of the mathematics resource community through interaction with mathematicians and their professional organizations;

2. perceive themselves as effective, empowered agents of the professional education community; and

3. discover new and effective ways to motivate students to study mathematics which will increase the number of students successfully completing high school mathematics programs and increase student awareness of the importance of mathematics.

B. Context

The enrollment of Kindergarten through twelfth grade students in the Los Angeles Unified School District increased by 11,000 students during the fall of 1986 to a total enrollment of 590,287. Of these, nearly 155,000 are enrolled in high schools or magnet schools. As of the 1985-1986 school year, nearly 14 percent of all students enrolled in California public elementary and secondary schools attended Los Angeles schools, and the Los Angeles schools enrolled 45 percent of all students who attended schools in Los Angeles County.

The Los Angeles Unified School District employs 29,221 Kindergarten through twelfth grade teachers at an average annual salary of $30,337. About 79 percent of the district's $3 billion operating budget comes from state funds; of the remaining 21 percent, 9 percent comes from local property taxes, 8 percent from federal funds, and 4 percent from other sources. The average cost of educating a Los Angeles school district pupil during 1985-1986 was $3,402.09.

Enrollment for the 1987-1988 school year is projected to increase by 15,000 students, the majority of whom will have limited English skills. Steady enrollment increases have pressured the superintendent and the School Board to develop a plan to deal with school overcrowding. In December, 1986, the School Board delayed for a year the decision to convert additional schools to year-round programs. Instead, the Board approved the addition of 265 portable classrooms, and transferred 9,000 students from overcrowded schools to schools with available space, changing the integration ratio from 60:40 to 70:30. The delay in converting to a year-round school program allowed more time for planning.

Other situations facing the district include a dearth of qualified teachers, especially in inner-city schools, and the potential disruption of new leadership. Los Angeles lost many mathematics and science teachers when the courts ordered that faculty desegregation precede student desegregation; many teachers chose to leave the system rather than relocate to inner-city schools. This has greatly reduced the number of experienced and qualified teachers, especially in fifty-five inner-city schools. As a result, these schools have been granted priority with regard to hiring new staff. In addition, the district's requirement that mentor teachers, who receive an additional $4,000 in salary from the state, be willing to change schools to help inexperienced teachers has caused many mentor positions to go unfilled. The district has only four mentor teachers of mathematics in all of its junior and senior high schools. Finally, Superintendent of Schools Harry Handler will resign at the end of the current school year. A nationwide search is being conducted to fill the position, and Handler has agreed to serve as a consultant for one year to assist a new superintendent.

C. Development of the Collaborative

The thirty-five-member Advisory Committee to the Los Angeles Educational Partnership, which constitutes the LAUM/SC, has been chaired since March, 1986, by Erwin Tomash, chairman of Data Productions Corporation. The Collaborative Advisory Committee is responsible for developing policy for the four mathematics and science programs administered by the LAEP. The Collaborative Advisory Committee is comprised of the lead +PLUS+ teacher from each school; Board of Education members; administrators and instructional specialists from the Los Angeles Unified School District, the El Monte Union High School District, and the Los Angeles County Office of Education; and representatives from foundations, museums, corporations, professional organizations, and post-secondary institutions. Members of the Board of Directors of the Los Angeles Educational Partnership serve as ex-officio members of the committee. The Collaborative Advisory Committee meets as a whole two or three times each year. Peggy Funkhouser, Executive Director of the Los Angeles Educational Partnership, is director of the collaborative. The coordinator of the LAUM/SC is Toby Borenstein. The on-site observer is Richard Curci, a high school mathematics teacher and a mentor teacher.

The Ford Foundation's Urban Mathematics Collaborative project funds the +PLUS+ (Professional Links with Urban Schools) program. Steering Committees are designated as needed to plan and make decisions for +PLUS+ activities. Teachers, business associates, and college associates who participate in +PLUS+ activities are considered members of the +PLUS+ program. In addition, in April 1985, the mathematics departments at three high schools, Manual Arts and Wilson High Schools (in the Los Angeles Unified School District) and Mountain View High School (in the El Monte Union High School District) were selected from a targeted set of forty-seven mathematics departments to form teams with business and post-secondary associates. These three departments are referred to as +PLUS+ departments. They were established to strengthen mathematics instruction and build links to the world of work. Teacher participation in the +PLUS+ departments was voluntary and varied from school to school. At Manual Arts, all sixteen mathematics teachers are +PLUS+ teachers; at Wilson, six of the twelve mathematics teachers are +PLUS+ teachers, and at Mountain View, all eleven mathematics teachers are +PLUS+ teachers. These participants represent a cross section of mathematics teachers with respect to knowledge and experience.

A +PLUS+ team, including the participating teachers, two business associates, one university associate and a facilitator, was formed for each of the three schools. During the first year, each of the three +PLUS+ teams developed an Action Plan, detailing its activities for the 1985-1986 school year. Before writing the plan, the members of the +PLUS+ teams attended two retreats, made summer site visits to industry and universities, participated in skill training, and attended team planning meetings. Each team was eligible for $2,500 in collaborative funds to implement its plan, and the school district provided release time for the teachers. The grant proposals were due January 15, 1986, and the grants were awarded by February 15, 1986. Each Action Plan outlined its team's goals and objectives; proposed activities, with the responsible team member listed; and described potential outcomes.

Goals expressed in the Action Plans varied for each team. The Wilson High School team wanted to improve communication and sharing within the mathematics department; the Mountain View High School team's goal was "to link students' learning to the realities of society in which we live." The Manual Arts High School team cited several goals: (a) to centralize general resource materials for the mathematics department; (b) to expose students to the practical applications of mathematics skills and concepts in the professional world; (c) to interest and help students to participate in department activities and programs; and, (d) to improve the operations of the department.

On March 18, 1986, members of the Advisory Committee met to review the +PLUS+ program and the proposal for Phase II. Fourteen people attended. Status reports on each of the three +PLUS+ teams were presented, and future activities were described. The Advisory Committee discussed refining the program model and expanding it to include the mathematics departments in additional schools.

During the 1985-1986 school year, the Teachers' Council, an informal group comprised of teachers from the three teams, met occasionally to share team activities. During the 1986-1987 school year, the Teachers' Council will become more formal and will meet once each month to help the collaborative meet the needs of teachers. This new Teachers' Council will include representatives from each +PLUS+ department, and from such groups as the California Mathematics Council, as well as from other eligible school districts. The Council will determine whether its membership should be limited to +PLUS+ high schools, how it will be governed, and how it will be represented on the Advisory Committee.

The formal Teachers' Council met for the first time on December 12, 1986. Members of the three pilot teams were invited to attend a potluck supper at the home of a teacher from Mountain View School; the gathering allowed the teachers to socialize, to talk about the past and the future, and to identify the Council's focus. Each of the nine teachers who attended identified a Council priority, such as promoting the collaborative, reviewing the curriculum, and fostering internships. Many also discussed areas for personal improvement, such as public relations, teacher training, and workshop design. Participants viewed the gathering as very successful.

Each of the three high schools, Manual Arts, Wilson, and Mountain View, experienced some personnel changes during 1986. In March, the Chapter I coordinator and the assistant principal at Manual Arts High School transferred to Wilson High School, one mathematics teacher transferred to Pasadena, and the three new teachers who joined the mathematics faculty chose to participate in the +PLUS+ program. At Wilson High School, two new mathematics teachers joined the staff, but these teachers are not participating in the +PLUS+ program. Two mathematics teachers left Mountain View High School at the end of the 1985-1986 school year; they were replaced by one full-time, first year mathematics teacher and a social science teacher who teaches one mathematics course.

During the 1986-1987 school year, the number of targeted mathematics departments in the +PLUS+ program will be expanded from three to eight. Efforts will be made to identify target schools from at least three additional school districts, so that a minimum of five districts will be represented by the eight target schools. Rigorous conditions for program participation have been developed. Sixty percent of the members of a department (including the chairperson) must agree to participate in development of the school's Action Plan, and the entire department must endorse the programs outlined in the plan.

Mathematics departments that participate in the +PLUS+ program will be eligible to receive only one planning grant. This restriction will ensure that departments will not become overly dependent on outside funding, and will more readily incorporate +PLUS+ activities into their regular procedures. The three original +PLUS+ departments will be exempted from this restriction during 1986-1987.

To increase awareness of +PLUS+ activities, eleven school districts were invited to send representatives to a +PLUS+ orientation meeting on October 9, 1986. Nearly fifty people from seven districts attended. Thirteen of the twenty eligible high schools in the Los Angeles Unified School District, and ten of the twenty-seven eligible county schools, were represented. The program included an overview of +PLUS+, a description of a +PLUS+-sponsored fall workshop series, and a session in which teachers from the original +PLUS+ teams shared their experiences and answered questions. The meeting encouraged teachers to attend the upcoming workshops, exposed participants to collaborative activities, and helped to identify the needs of the various districts. Finally, the meeting was designed to stimulate departments' interest in being one of the five new high school mathematics departments to become a +PLUS+ team.

D. Relationship with Other Local Initiatives

Dr. Warren Newman, project evaluator for the LAUM/SC, conducted an evaluation on the impact of +PLUS+ in the three target schools during the 1985-1986 school year.

A pre-survey was administered in the fall to teachers from each of the three pilot schools; a post-survey was administered to the same teachers in the spring. The pre-survey asked teachers about their perceptions of the ideal mathematics teacher in eight specific categories. The post-survey assessed any changes in the teachers' self-perceptions in the same eight areas.

Dr. Newman concluded that "the +PLUS+ Program, as initiated in 1985-1986 by the Los Angeles Educational Partnership, has had a positive effect on the staffs at all three schools." It is clear from Dr. Newman's findings, however, that the collaborative's effect on professional growth and in meeting the goals of the project varied to some degree among the three schools.

E. Project Activities

The Los Angeles Urban Mathematics/Science Collaborative sponsors three distinct kinds of activities: events for teachers from the forty-seven targeted schools in the eleven school districts (General Activities); joint activities for all three +PLUS+ teams (Activities for All +PLUS+ Departments); and activities designed by each team as part of its Action Plan (Team Activities).

GENERAL ACTIVITIES

+PLUS+ Workshop Series

A major effort of +PLUS+ Phase II is a series of content workshops scheduled four Saturday mornings: November 8, December 13, January 10, and February 21, at Wilson High School. Teachers from forty-seven high schools in eleven school districts were invited to attend. The workshops were planned by a task force of +PLUS+ teachers and associates from higher education and industry, as well as other members of the Los Angeles Urban/Math Science Collaborative. University professors, outstanding classroom teachers, and industry professionals will direct the workshops, which will focus on topics identified by the Workshop Steering Committee of the LAUM/SC. The number of workshops was reduced from five to four due to low enrollment in mathematics modeling and advanced mathematics; these two were combined into one workshop. The final series includes: FUNdamentally Math, New Directions in Mathematics, Effective Software for the Math Classroom, and Scientific Uses of Mathematics Modeling/Advanced Math. A session on each of the four topics will be offered on each of four Saturdays.

All the workshops are highly interactive and utilize a hands-on approach, incorporating manipulatives, models, and simulations. Similarly, all four workshops stress problem solving, estimation, and mental arithmetic, and the use of calculators while exploring real-life applications of mathematics.

Each workshop topic will be addressed in four half-day sessions, totaling 16 hours over a four-months period. Teachers will earn one salary-point credit from the Los Angeles Unified School District or professional expert pay of $150, one half to be paid by the LAUM/SC and one half to be paid by their school district. Each workshop will accommodate sixteen to twenty teachers; up to eighty teachers may participate in the series. Teacher Resource Books will be developed by the teachers at each workshop for dissemination to all participants. These books will contain ideas, field-tested lessons, worksheets, lists of material resources, bibliographies, and lists of guest speakers.

The thirty-three workshop instructors represent a variety of groups; six instructors are from corporations, six are from universities and colleges, five are from county or district offices, and sixteen are teachers from ten schools.

During the weeks between workshops, participants will practice and apply the new ideas and methods to their own classes and report their results at the following sessions. This strategy provides the opportunity to field test new ideas in a variety of settings, receive suggestions from colleagues, request new information and feedback from experts, and feel a sense of ownership in the development of the eventual product, the Teacher Resource Book. This strategy also recognizes the developmental nature of learning, sets in motion the integration of new information into the mathematics program, and most importantly, recognizes the central role of the classroom teacher as the agent for change.

The workshop's Steering Committee felt very good about the planning meetings and the potential overall value of the workshop series. After the committee's first meeting, an industry associate said, "This is an exciting project and it is interesting to see how schools operate differently from Hughes. I'm glad I could participate." After a later meeting, one teacher said, "I'm glad I'm a part of it. This is going to be a great series of workshops." An industry associate commented, "This is opening up positive dialogue between classroom teachers and administrators. It's transferring what teachers need to the power structure of teaching."

At the end of August, the workshop Steering Committee met to help two of the subcommittees finalize their fall workshops. After this meeting, one teacher commented, "We are almost finished, and it is worth every minute." Others said: "Glad to see some industry people working with us. They have good advice;" "The team work is good to be a part of. The strength is in working together."

On September 5, 1986, a luncheon meeting was held to coordinate the fall workshops, to report on progress, and to plan for the Presenter's Orientation scheduled October 2. After the meeting, one teacher commented, "Every time I come to one of these I feel energized. There is a group of outstanding people assembled." The on-site observer said, "Everyone was excited to be involved, and there was mutual respect by all who attended."

Kickoff Reception. Wells Fargo Bank hosted a kickoff reception on November 5 at the Crocker Conference Center for all participants in the +PLUS+ Workshop Series. Dr. Henry Pollak, who had recently retired from Bell Telephone Laboratories, spoke on "The Shortest Connecting Networks." Of the seventy-five people who made reservations, thirty-five actually attended, including thirteen teachers from the three +PLUS+ departments. Teachers' comments were mixed; they enjoyed socializing with one another, but some felt the speech topic could have been better chosen. Asked whether the activity was worthwhile, teachers responded: "Yes. The people here are friendly, and I learned something"; and "Yes. Sharing information is so necessary." The on-site observer felt that the activity was well organized and that, in general, participants found it worthwhile. Teachers especially appreciated the opportunity for interaction with their peers.

Lee Dembart, the Los Angeles Times science editor and a friend of Dr. Pollak, attended the reception and was asked to attend the November 8 workshop. After attending Bill Lucas' workshop, Mr. Dembar wrote an editorial that appeared November 13 in which he described the workshop and promoted discrete mathematics as the mathematics of the computer. The editorial noted that the twelve high school teachers who participated in the workshop spent time developing ways to adapt the problems presented in the workshop into curriculum enhancements for their classes. Dembart concluded: "The effort to bring this to school children and to show them that theoretical mathematics is a living, breathing, developing science is a commendable undertaking that promises large rewards."

November 8 Workshop. The November 8 workshop offered sessions on cooperative learning, profit analysis, operations research, computer careers, and developing intuition in science. The forty teachers who attended rated the event positively, with each of the sessions receiving an overall average rating of 4.5 on a 5-point scale, with 5 indicating "very valuable." Words frequently used to describe the workshops included "informative," "exciting," "interesting," and "stimulating." When asked what they liked most about the workshop, participants responded: "I now have a way to use my more capable students' abilities without starting a separate class", "problems related to industry"; "showed some problems which are hard to solve yet easy to understand"; "hands-on software examination"; "some entertaining problem situations for visualization, thinking, and solidifying"; and "coordinators were very willing to tailor workshop to suit participants needs." Most teachers noted that they will try to adapt ideas from the workshop for use in their classrooms.

Teachers comments about the value of the workshops included: "You can teach an old dog new tricks. I never realized the retail business used this amount of math. Great exercise." One of the business associates noted, "I enjoyed being with the math teachers, and I'm available for field trips and to speak to math classes."

To encourage attendance at future workshops, the coordinator announced that if a teacher brought a colleague to the December 13 session, the teacher would receive $40 to purchase extra materials for his or her school, and the new teacher would receive $110 for attending the three remaining sessions.

December 13 Workshop. The December 13 workshop offered sessions on problem solving, experiments and game theory in the theory of fair division, the Geometric Supposer, and statistics. Fifty-five teachers attended, including fifteen who had not attended the first workshop. Overall, teachers gave the workshop an average rating of 4.5 on the 5-point scale, and their comments were very positive: "These are the best workshops"; "The Geometric Supposer is fantastic. Can't wait to use it"; "This is exciting. We are learning about statistics"; and "These are by far the best (workshops). Great atmosphere and everyone is friendly. Small size gives all a chance to participate." The on-site observer added that the quality of the speakers and the size of the groups contributed to the success. Alan Amundsen, one of the speakers, was very encouraged by the number who had pre-registered for the software workshop and believed that the proximity of a holiday may have been responsible for the low turnout at the November session. Amundsen felt the word about the workshops was spreading. Teacher evaluation forms indicated that many would use workshop ideas in their classrooms.

A few of the presenters, primarily from the Los Angeles Teacher Education and Computer Center (TECC), expressed the view that +PLUS+ should not be sponsoring workshops as too many workshops already were available. However, workshop participants have found the sessions very helpful. According to the on-site observer, one positive aspect of the workshops is that they bring together people from a number of different sectors (city and county school district administration, city and county schools, TECC, industry, and higher education) to accomplish a task. The process has fostered meaningful communication and increased interaction and listening among participants.

ACTIVITIES FOR ALL +PLUS+ DEPARTMENTS

Team Building Activities

Initial Team-Building Activities. During 1985, the pilot year of the collaborative, a three-day Kickoff Retreat brought together the school participants, and the university and industry associates. Three teams were formed, with each team consisting of the teachers from one of the high schools, two business associates, and one university associate. As an outcome of the retreat and to help teams develop Action Plans, site visits were held in each high school in late May and early June, and at industries and universities during the summer. During the site visit, each team noted ways in which resources could be used to meet identified needs.

In the fall, a one-day retreat, planned by team leaders and facilitators, brought the teams together to share experiences, to review needs and resources, and to integrate these into plans. Two of the three teams appeared to have difficulty identifying resources to meet their needs. As an outcome of the retreat, a team workshop on self-awareness, conflict resolution, problem solving, and communication skills was scheduled.

Team Workshop. A team-building workshop was held December 7, 1985, in the Museum of Science and Industry. The teams made significant progress in completing their proposals for the $2,500 planning grants, due in January, 1986. Teachers commented that the workshop allowed them time to become closer and to get to know one another; they also expressed the opinion that it was good to be in an environment other than the classroom. However, individual teams viewed the experience differently. The most positive comments were made by those from Mountain View, and Manual Arts teachers made good progress on their plan. Teachers from Wilson enjoyed the college-like environment, but they had difficulty coming to agreement on goals that they all could pursue.

Galaxy Sound Studio Tour and Planning Grant Presentation. On February 12, 1986, a mid-year gathering for collaborative members was held at the Galaxy Sound Studio; the districts' mathematics specialists also were invited to attend. A studio tour highlighted the use of mathematics and the careers available in the sound-recording industry. At the social gathering following the tour, each team received the $2,500 grant to implement its Action Plan. Representatives from each school were excited and proud that they had accomplished so much in the past year.

Pilot Year Assessment

Several meetings were held in February and March, 1986, to assess the pilot year of the +PLUS+ project and to determine adjustments for Phase II. In late February, Peggy Funkhouser and Toby Bornstein met with the Human Resource Specialist from LAUSD, the secondary mathematics specialists from the Los Angeles Unified School District and the El Monte Union High School District, and the three team facilitators to review the year's activities and progress.

At Mountain View, where mathematics teachers averaged 10.9 years experience in the classroom, all mathematics teachers were members of the +PLUS+ team. The Mountain View plan focused on student achievement, motivation, and careers. The team' strengths were the leadership of its department chair, who is a mentor teacher, and its cohesion. Its weaknesses included a need to improve the documentation and dissemination of its accomplishments.

At Wilson, where mathematics teachers averaged fifteen years experience in the classroom, six of twelve mathematics teachers were +PLUS+ members. The Wilson plan focused on department cohesion and sharing of materials. The team's greatest strength was talented membership and its greatest need was team leadership.

At Manual Arts, where mathematics teachers averaged 5.9 years experience, all sixteen mathematics teachers were +PLUS+ members. Manual Arts' plan focused on department organization and student motivation. The team's biggest plus was the establishment of a new teacher leadership core; its greatest need was to feel powerful in a non-supportive environment.

End-of-First-Year Review

On March 6, 1986, a meeting of the +PLUS+ project was held at Wilson High School to evaluate the program, to review the project's first year, and to make suggestions for the future. The three +PLUS+ teams were invited; no representatives from Manual Arts attended, nor did business representatives from any of the three teams. These in attendance included the director and coordinator of the collaborative, a facilitator, the secondary level mathematics coordinator from LAUSD, and a teacher-in-residence from UCLA. The discussion focused on team self-evaluation, and all the teachers appeared extremely positive about their participation in +PLUS+. One teacher said, "I've been teaching for many years and this is one of the first projects I've truly been excited about. Being able to talk math with other math teachers and experts in the field is wonderful. Another exciting part is the resources it has put me in contact with. I enjoyed the site visits and the lectures." Other commented: "I like the human contact, like talking to my department members. The meetings we have every Thursday have been very helpful"; and "Momentum is building and it is exciting to be part of it all." A department chairman said, "Everything we do with +PLUS+ makes our department better. I think of +PLUS+ as one of my tools. It makes me and the people I work with better."

Nonetheless, teachers did express frustration at the time commitment required by their participation in +PLUS+. A teacher said, "It takes too much time to come to simple solutions. Takes too long to expedite plans." Another said, "I've never spent so much time away from my home; it is because of +PLUS+. I see results, but I wish it didn't take so much time. I hate going through processes."

While teachers acknowledge that collaboration is a slow and time consuming process, they appear to feel it has a lot to offer them. However, many have had difficulty learning how to use such resources as the facilitators. As one department chair said, "In the past, we have learned to make due with what we have. Now with these resources that are out there, we need to learn how to ask for help. Teachers haven't learned to ask how to get things by being the squeaky wheel. We don't know how to deal with the system. Teach us to learn how to learn." The on-site observer said, "The first year was a learning year, and no one knew what to expect. I have seen each of the math departments become a closer and more effective team due directly to their membership in +PLUS+."

Assessment Instrument

In April, 1986, an assessment instrument was administered to collaborative teachers, to the collaborative coordinator, and to the lead facilitators. Assessment results were used to propose changes for Phase II and to provide input on participants' interests, their views on collaborative governance and leadership, and on the appropriate structure of the collaborative. Assessment results were presented to the Advisory Committee on April 29, 1986; the committee used them as the basis for its recommendations for the Phase II proposal.

Team-Organized Dinner Meetings

Team dinner meetings were held during the spring of 1986 to foster teachers' relationships with their business and university associates. The Wilson team organized three dinner meetings, to which all three teams sent representatives, and the Mountain View team organized a dinner meeting of its own.

The Wilson team planned its first dinner meeting at UCLA on April 9. Dr. Moshe Rubenstein of the UCLA School of Engineering spoke on problem solving. Participants included five representatives from UCLA (including two team members), five teachers from Wilson, two teachers from Mountain View, and four teachers from Manual Arts. All the teachers indicated that the activity was a complete success; they were very impressed with Dr. Rubenstein's lecture and commented that they had gotten some very good ideas on problem solving from it. The associate from UCLA commented, "This was a very informative lecture."

The May 2 dinner meeting, also planned by the Wilson High School Team, was sponsored by GTE and held at the Pasadena Hilton. Approximately thirty people attended, including six teachers from Wilson and their spouses, the UCLA associate, and Peggy Funkhouser. The meeting was designed to highlight how mathematics is used in the communications industry and to inform teachers about the mathematics skills required for the GTE employment exams. Representatives from GTE's Personnel Management and Information Processing departments addressed the group.

In general, the teachers enjoyed the dinner; however, most expressed disappointment that they were not given concrete examples of the mathematics required on the employment tests. They also said the presentation did not provide any information beyond that given at the site visits the previous summer. The on-site observer suggested that the teachers' disappointment may have stemmed in part from their own failure to communicate their expectations to GTE representatives prior to the meeting. The dinner did reaffirm the continued interest and commitment on the part of GTE to work with mathematics teachers.

The third dinner meeting, sponsored by Hughes Aircraft and planned by the Wilson team, was held May 15, at the Green Jade Chinese restaurant. All +PLUS+ team members were invited, and twenty people attended: seven from Wilson, two from Mountain View, eight from Hughes Aircraft, the UCLA associate, Toby Bornstein, and Richard Curci. Linda Barkley, of the Systems Application Laboratory of the Hughes Space and Communications Group and a member of Women in Math, spoke on "Applications in the Aerospace Industry." As part of her presentation, Ms. Barkley distributed handouts and asked the teachers to solve problems. Although Ms. Barkley agreed independently to give this presentation, a Hughes' tradition of encouraging team planning corresponds well with the collaborative's goals. The presentation was preceded by a social hour and was followed by dinner. During the evening, teachers were able to interact with representatives from Hughes.

Reactions to this dinner and to Ms. Barkley's presentation were extremely favorable. One teacher said, "I think this activity was the best yet. I enjoyed doing the problems." Another commented, "The problems were real life, and I could use her handouts in my Algebra II class." Many of the positive responses were a result of Ms. Barkley's approach: she got the teachers involved, gave prizes to the person who first answered the problem correctly, and provided the teachers with materials they could use in their classroom.

The fourth event, also held in May, was a pizza dinner organized by the Mountain View teachers at California State University-Los Angeles. Only teachers from Mountain View attended; the discussion focused on probability and statistics.

Phase I End-of-Year Dinner and Resource Exchange

On June 3, 1986, a meeting was held at the South Pasadena School District Office Building to allow +PLUS+ teachers and associates to share what each +PLUS+ school had learned and accomplished in the past year as a result of their involvement in the collaborative. Nine teachers from Mountain View and five teachers from Wilson attended. Janet Freeman from Hughes also participated, as well as two UCLA associates, Dr. Newman, and the director and coordinator of the collaborative project. Teachers had been asked by the coordinator to submit "one great lesson" they had developed; at the meeting, each teacher received copies of all the lessons that had been submitted.

Preceding dinner, a representative from each of the teams discussed the team's progress during the year. A discussion of "professionalism," as well as a brief update of plans for Phase II of the collaborative, followed the dinner. It was noted that the role of the facilitator had evolved into the role of a director, who took charge of team activities. This had occurred after it was determined that teams were not taking the initiative to plan their dinner meetings, and facilitators were asked to be more involved in organizing and coordinating these events. At Manual Arts, where the facilitator had resigned, Toby Bornstein had assumed these responsibilities.

The teachers appeared to be very positive about their teams' progress during the year. That sense of accomplishment had increased tremendously by June. One teacher said, "It is hard to believe how much we have accomplished. It was good to reflect and see what we have accomplished. We needed to do this so we could move on." The on-site observer commented: "This was a necessary meeting for all members of +PLUS+. It was rewarding to see them discuss what +PLUS+ has done for them. The sharing that took place and the new networks that they have set up made this year much better for them. Perhaps, most importantly, they felt more professional and good about themselves and their fellow +PLUS+ teachers."

Hughes Aircraft Brainstorming Session

On December 15, 1986, two to three teachers from each of the three +PLUS+ schools were invited to attend a brainstorming session to identify ways in which industry can interact meaningfully with teachers. The meeting was held at Hughes from 4:00 to 6:00 p.m. and included a buffet dinner. Fourteen people attended, including three teachers from Mountain View, three Hughes employees, five Hughes retirees, Peggy Funkhauser, Toby Bornstein, and Richard Curci. Participants felt that the meeting was worthwhile; the Hughes people are very interested in education and in helping teachers and students. One Hughes representative said, "I'd like to impress upon girls that math is an option. I'd like to try to have an effect on somebody." The on-site observer noted that the meeting was stimulating and productive, and that the ground work was laid to get teachers and industry people working together in a classroom. "Everybody in the room felt that something special was happening."

Professional Conferences and Association Meetings

During 1986, the collaborative supported the attendance of +PLUS+ teachers at several conferences, both within California and out-of-state.

National Science Teachers' Association Conference. In March, four teachers and Toby Bornstein, the project coordinator, attended the National Science Teachers' Convention in San Francisco. The Technical Assistance Project at the Education Development Center (EDC) funded the teachers' attendance in an effort to build relationships between mathematics and science teachers. In addition to attending the conference, the teachers met with members of the San Francisco collaborative to discuss activities, the San Francisco Internship Program, the Exploratorium, and the use of resources. The teachers also met with Mark Driscoll, director of the Technical Assistance Project. The teachers found the trip very worthwhile. While one of the teachers expressed the opinion that the convention itself could have been better organized, all the teachers seemed to feel that they benefited greatly from talking with their counterparts in San Francisco. The experience also instilled in the Los Angeles teachers a desire to learn more about the San Francisco collaborative's relationship with the Exploratorium, which resulted in their visit to the Exploratorium on May 5. At the conference, the project coordinator was given the name of a resource person from Hughes Aircraft, who has since become involved in the collaborative.

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy. In June, 1986, one teacher from each +PLUS+ team and the project coordinator of the +PLUS+ program attended a conference on computers in secondary school mathematics in Exeter, New Hampshire. The Technical Assistance Project sponsored two of the teachers, and LAUM/SC sponsored the third teacher and the coordinator. The conference focused on the impact and application of the computer in the curriculum. Other topics included discrete mathematics, new developments in mathematics, and issues in mathematics education. The conference allowed teachers hands-on experience working with computer software.

During the conference, the teachers attended two evening sessions on the Geometric Supposer presented by Richard Houvde. The workshop, organized by EDC, was attended by teachers from collaborative projects around the country. In addition, EDC sponsored a social gathering to provide an opportunity for teachers from all of the collaborative sites to become acquainted.

All three teachers and the +PLUS+ coordinator found the conference to be extremely beneficial. One teacher said, "The best conference I ever attended. I had a chance to work with many different softwares." Another said, "This was a well organized conference with many things to learn and do. I enjoyed every minute, especially meeting other teachers." The teachers presented what they learned at the California Mathematics Council-Southern Section on November 21, 1986.

High School Math Project. From June 30 through August 1, four teachers from Manual Arts High School were funded to attend the High School Math Project at UCLA and California State University-Los Angeles. The conference provided high school mathematics teachers the opportunity to interact with their peers, to learn new approaches to teaching mathematics, and to prepare a mathematics workshop. The conference appeared to be an excellent growth experience for all four teachers. One teacher said, "I enjoyed learning some new things. Having to present a workshop was most beneficial. All teachers should experience this." Another said, "I feel this was outstanding. It was highly organized. The math portion and mentor teachers were good."

National Conference on The Influences of Testing On Mathematics Education. On June 27 and 28, the collaborative sponsored a teacher from Manual Arts High School and the on-site observer to participate in a two-day conference on testing in mathematics education at UCLA. The conference was sponsored jointly by the Mathematical Sciences Education Board of the National Research Council and The Center for Academic Interinstitutional Programs of UCLA. The conference's primary purpose was to gather input from experts regarding the design of a major national study of the impact of testing in mathematics education. While the teacher who attended reported the discussion to be "a bit over my head," he did find it interesting.

California Mathematics Council, Southern Section Conference. On November 21 and 22, the California Mathematics Council held its annual conference for southern California in Long Beach. Four +PLUS+ representatives described the collaborative and the Exeter conference. Toby Bornstein, the collaborative coordinator, offered an overview of the +PLUS+ program, including a discussion of which school districts were eligible to join. Jim Wigton, of Mountain View, described the program in greater depth and discussed its benefits. Evelyn Torres-Rangel, of Wilson, discussed the Exeter conference, the Geometric Supposer, and the ways she used the software in her classroom. Pam Grey, of Manual Arts, added details to the discussion of the Exeter conference and offered information about some of the other conference sessions. About fifty people attended at least part of the session, including Norman Webb from the UMC Documentation Project. The three teacher participants felt good about their presentations; it was the first time any of the three had presented to a large group. They felt that their audience had become more familiar with +PLUS. Several other +PLUS+ teachers also made presentations. Lorrie Freeman of Manual Arts talked about bilingual education, and Tom Walters of Wilson talked about a trigonometry identity useful to solve cubic equations.

Exploratorium Visit

On May 5, five members of the Los Angeles Collaborative (two teachers, one department head, one industry associate and the on-site observer) met with ten teachers from the San Francisco Collaborative at the Exploratorium in San Francisco. The visit resulted from the meeting of teachers in March at the NSTA Conference. The activity was designed to allow +PLUS+ teachers to visit the Exploratorium and to hear Thomas Humphrey speak on conic sections, as well as to meet teachers from the San Francisco Collaborative. While in San Francisco, industry associate Janet Freeman purchased models of experiments that she later used to develop a model for the fall workshops.

All of the participants felt that the visit was valuable, and they were impressed with the Exploratorium and the presentation they had heard. One teacher said, "I was very impressed and stimulated by this experience. We need something like this in L.A. Being able to hear a lecture about conic sections, then go see exhibits relating to conic sections, is very valuable." Another commented, "This was worth every minute. I wish we could do this more often. It gave us an exciting lesson and made me feel enthusiastic again. I also enjoyed talking with the other math teachers." The department head said, "This is the first +PLUS+ activity I've attended, and I am impressed. The use of the Exploratorium is a great idea. Tom's presentation was first class." The industry associate said, "I thought this was one of the best activities I have attended." She expressed the hope that her firm would "be able to work something out with the Museum of Science and Industry in Los Angeles so mathematics teachers can get some hands-on experience. Mathematics teachers need to see how mathematics models are used in science." Since then, the associate has made a second trip independently to discuss the idea further with the Exploratorium staff.

Summer Internships

A pilot summer internship program was planned for the summer of 1986, involving seven internship positions in local industries.

Participating teachers were to be hired for a six- to eight-week period and were to receive a weekly salary of $400 to $600. Each participating teacher was to be paired with an industry associate, who would serve as a resource person in regard to both corporate work and classroom application. As part of the program, the Teacher Interns would be required to develop a unit project or supplementary materials to augment the existing curriculum. Furthermore, the interns were to participate in regularly scheduled weekly meetings with the industry associate to discuss applications of the summer work experience to classroom teaching. Participating teachers also were expected to attend weekly half-day field seminars with other +PLUS+ teachers.

This year, only one of the seven internship positions was filled, as most teachers had already made summer commitments by the time the program was announced. Also, the application form included a survey of computer experience that many teachers found intimidating. Some teachers believed the program would not actually occur; others did not believe they had anything to offer industry. The coordinator felt there was too little time to develop the program, given the other project accomplishments during its first year.

TEAM ACTIVITIES

In February, each of the three +PLUS+ teams was awarded a $2,500 grant. In writing the grant application, each high school had to define its professional needs, explore resources, and develop a program of activities to meet these needs. As a result, each team developed a schedule of activities to meet the needs of its specific school. Within the scope of these activities, each team was required to include: departmental planning meetings, three facilitated team planning meetings to be hosted by associates, use of five staff development days for planning or execution, and a school/community meeting during Open House Week. The activities of each +PLUS+ team are described below. In fall, the efforts of the teachers in all three +PLUS+ departments focused on preparations for the +PLUS+ workshop series. Teachers served on planning teams for each workshop topic and in many cases served as the teacher coordinator for specific workshops.

Wilson High School

The +PLUS+ teachers at Wilson met every Thursday during lunch to share ideas and to plan. On occasion, speakers with an interest in mathematics were invited to attend, but generally the +PLUS+ teachers met alone. A list of potential speakers is being compiled. The meetings also offered opportunities to evaluate software and to arrange field trips.

Five staff-development days were allocated to the +PLUS+ teachers during 1985-1986 to use as they saw fit. The team's Action Plan indicated that these days would be devoted to (a) making videotapes for in-school guidance classes, featuring Wilson graduates using mathematics in their jobs; (b) designing supplementary materials for Algebra I classes, and (c) developing lesson plans involving calculators for use in all basic mathematics classes. The only activity the team actually addressed during the 1985-1986 school year was the calculator lessons; they decided that the videotape project was too ambitious an undertaking, and found a good algebra text that had its own supplementary materials.

The three facilitated team planning meetings that were to be hosted by associates were not held; instead, the facilitators planned the dinner meetings held on April 9, May 2, and May 15.

On April 11 and 12, the Wilson High mathematics teachers and their families, along with Toby Bornstein and her family, went into the mountains for a Halley's Comet Watch weekend. The outing was planned as a social event, as well as an opportunity to observe Halley's Comet. The activities were designed to observe the comet with an eye to developing mathematics lessons and to encouraging closer bonds among team members. Participants had a good time and said they would do it again. The coordinator felt that the experience was invaluable in that it engendered in the teachers a sense of membership in a cohesive group.

On April 17, the Wilson team held an Open House. Seven hundred parents came to the school-wide event. Teachers also used the opportunity to plan for the next dinner meeting.

In November, 1986, the Wilson +PLUS+ team received a $1,000 grant from General Telephone of California to be used for a repair contract for the school's Hewlett Packard computers. This occurred through the group's connection with the GTE associate and was pursued by one of the teachers. Team members were delighted with this success.

Training received at Exeter prompted mathematics teachers to push for access to the computer lab at Wilson High School so that new software, such as the Geometric Supposer, could be used by geometry students. With the principal's support, one of the two computer rooms was made available for that purpose. Four teachers were scheduled to teach in the room. In the fall, four of the eight geometry classes used the Geometric Supposer under the direction of Alan Amundsen, who went to Boston in November to be trained to use the software.

Mountain View

The Mountain View +PLUS+ team names its program LINKS; through the team grant, team members planned to explore ways in which they can "link" students and their learning experiences to the realities of the society in which we live. To increase student awareness of the need for and the uses of mathematics in the business world, a field trip to Northrop Corporation was planned for April 11; thirty students participated. Furthermore, summer internships were organized, and one student worked for TRW, a multi-faceted company, during the summer of 1986. Speakers were brought in through the career center on campus, and staff-development experts were identified to provide inservice on cooperative learning and software. As an outcome of the interchange with the staff development consultants, there are computers and printers in four Mountain View classrooms.

The mathematics department at Mountain View, which was selected to participate in the Classroom Teacher Instructional Improvement Program (CTIIP), was awarded a grant of $3,000 to develop problem-solving strategies at all levels of mathematics. The department worked to revise its curriculum to conform with new state mathematics framework topics at all levels. Part of this revision involved acquiring materials and software to enrich the mathematics lab.

To improve student achievement in mathematics, the mathematics department initiated a math-achievement reward system in which students receive raffle tickets with a chance to win prizes for above-average performance in the classroom. To help achieve that performance, the teachers began voluntarily donating their time before, during, and after school to provide tutoring in all areas of mathematics. In addition, tutoring personnel were expanded by using business contacts at Northrup. The first raffle drawing was held March 20, and the second May 18.

Two team meetings were held with the help of the facilitator during the year. In March, the facilitator hosted a meeting at his home for all of the school's mathematics teachers. In April, the facilitator organized the pizza dinner at California State University-Los Angeles.

Mountain View held an Open House on April 2. At this meeting, parents received a written report of the LINKS Program and information on the tutoring program.

Manual Arts

Activities at Manual Arts have been directed toward providing for basic needs of the mathematics teachers. One such need was school space that could be identified as belonging to the mathematics department. In late December, two teachers converted an unused room into a mathematics office. The office has served to centralize resource materials, to promote the exchange of such materials, and to enhance interdepartmental communication. The teachers appear to be very proud that they now have this special area; before the office was established, mathematics teachers rarely would see one another because many teach in different buildings.

The team also has worked to organize several mathematics competitions. Algebra contests were held January 31, March 22, and June 6, and a competition for Basic Math students was held March 21. The events were very successful, and the teachers said they enjoyed working together and seeing the students excited about mathematics. The teachers who created the mathematics office also established the competitions.

Only one of the three planning meetings designated in the Action Plan actually occurred. On February 17, the teachers met with the team's associate at ARCO. As a result, ARCO representatives spoke to four classes of students about people who have been successful in business. This was a part of a newly established Career Speakers Series.

In March, a student tour of CSULA was planned for fifty selected algebra students. This activity was designed to motivate students toward the practical applications of mathematics and provide enriched opportunities to interested students. The tour never took place.

In April, the +PLUS+ team at Manual Arts held an Open House. In May, an activity entitled "Women in Math" was planned for Math Club members. Another goal of the Manual Arts team was to establish a Joint Education Project Tutoring Program through which college students tutor high school students in Basic Math and in Algebra I. One of the teachers worked very hard to initiate this program with USC; in the past college students had been reluctant to visit Manual Arts. Two years ago only a handful of USC students would assist in Basic Math tutoring; currently enough tutors are available so that two to three tutors can be assigned to each teacher.

F. Observations

The establishment and development of the Los Angeles Urban Mathematics/Science Collaborative has been founded on two basic strategies. The first involves focusing initial efforts on the mathematics departments of three target schools, and increasing the number of target schools each year. This approach has been necessary because of the size of the area being served by the collaborative in terms of distance, number of districts, number of teachers, and number of students. The collaborative's second strategy involves encouraging collaboration through the formation of teams of teachers, university associates, and industry associates. The teams serve as the central force for creating greater leadership among teachers, increasing effectiveness, fostering networking among the various groups, and improving the mathematics curriculum.

The three pilot sites provide an interesting contrast and a good test for the collaborative. While progress has been made at all sites, the degree of involvement has varied among the three schools. This has been influenced by the level of teacher involvement and the working relationships among staff prior to +PLUS+. The issue now is whether the lessons learned at three schools can be applied to other sites as the collaborative expands.

PROJECT MANAGEMENT

The collaborative is managed to a great degree by the coordinator, with advice from the Advisory Committee and with the help of activity-specific steering committees. The steering committees, such as those used to plan the fall workshops, have proven very useful in spreading responsibilities to a number of people, including teachers, university associates, and industry associates.

Currently, the coordinator appears to be working at maximum capacity and is experiencing some frustration at not achieving all of her (admittedly ambitious) goals due to time constraints. As the project moves from its initial developmental phase, the organizational structure will need to change with it. Greater complexity will demand increased support. The growth of a cadre of teachers experienced in the +PLUS+ project and the development of the Teachers' Advisory Council will facilitate some redistribution of work and foster greater teacher ownership in the overall program. The need will persist, however, for coordination and administrative support. It will be of interest beyond the particularities of the Los Angeles collaborative to document how this issue of development is dealt with over the next several years. Not only will the projected development of +PLUS+ involve an increasing number of schools, but the total will increase in greater increments each year. For example, the number of schools will increase from three in 1985-1986 to eight in 1986-1987, and to fifteen in 1987-1988. The new schools will be selected from different districts so that the number of districts involved also will increase each year.

The coordinator has assumed responsibility for communication within the collaborative. She has kept teachers at the three target schools informed, updated the advisory committees on the collaborative activities, and prepared the reports of collaborative activities. She visits the schools to talk with teachers during their breaks and lunch times in order to maintain personal contact with them. The manner in which communication links are established and maintained as the number of participating schools increases will provide one indication of the viability of collaborative growth. It appears that expansion will demand increased delegation of responsibility to the teachers. In planning the fall +PLUS+ workshops, teachers took it upon themselves to communicate with one another. Electronic mail also has been used to maintain communication among the sites. This may help, but it will not eliminate the need to focus on the issue of communication as the number of sites increases.

Spreading the word to the larger community, comprised of the forty-seven schools, has presented an even greater problem. Ensuring that collaborative information is directed to the correct person in each district has been a challenge. During the first year, the coordinator depended on the mathematics supervisor in each district to identify the right person, but this was not very productive and resulted in low attendance at collaborative events held for all districts. This year, the collaborative coordinator identified the right person in each district and the number of districts represented at general events increased. Workshops attendance also is increasing as teachers spread the word about the quality of the sessions. Increased interest in the collaborative suggests that information is being disseminated and change in collaborative procedures indicates that lessons are being learned.

COLLABORATION

One objective of the collaborative is to promote a feeling of camaraderie among the mathematics teachers within a school. The three target schools varied greatly in terms of how the teachers related to one another prior to joining the +PLUS+ project. Manual Arts mathematics teachers were isolated in separate buildings and interacted only rarely. Wilson mathematics teachers met on occasion as a department and would see each other throughout the school day. Mountain View mathematics teachers met regularly at school and socially at a dinner gathering once each month. After a year of collaborative participation, some changes have been observed that appear to be the result of collaborative activities. At Manual Arts, an empty room has been converted to an office for mathematics teachers. This space enables mathematics teachers to congregate over lunch or while preparing materials, and it appears that the teachers have initiated some level of group communication. While some teachers have assumed individual or small-group projects, such as establishing a tutoring program involving college students and painting an office for mathematics teachers, there remains a sense that group communication could be improved.

At Wilson and Mountain View, mathematics teachers communicate on a regular basis. At Wilson, the six +PLUS+ teachers frequently eat lunch together, and they have gone camping together; this relationship is a direct result of their association with the collaborative. At Mountain View, the high level of interaction among the mathematics teachers has continued throughout their involvement in the collaborative. While the collaborative has facilitated communication within all three schools, the degree of team building that has occurred varies by school. The evolution of communication among teachers at Manual Arts will be a true indication of the impact of the team approach.

Planning meetings for the +PLUS+ workshops and dinners have encouraged interaction among teachers from different schools. The effectiveness of these activities is evidenced by the participation of teachers from different schools in cooperative activities, such as joint presentations and an incident in which a teacher at Mountain View taught classes for a teacher at Wilson.

Within each site, team management and the collaborative direction have depended to some degree on the group's cohesiveness prior to collaborative involvement. The resolution of organizational issues appears to be as important as dealing with instructional issues. Thus, a dual set of focuses have emerged in the +PLUS+ program: the first is a concern for leadership development, and the second is an increased emphasis on the mathematical and pedagogical content of activities. Schools progress on these at independent rates. Organizational and pedagogical issues will continue to exist concurrently, and, in fact, may be confounded as more schools join the collaborative and there is an increasing disparity among schools in terms of their experience with the program.

TEACHER PROFESSIONALISM

The planning process for the +PLUS+ workshops offered an impetus for the development of teacher leadership. The workshops were prompted by the pilot teachers' need to develop classroom applications for ideas they received through contact with practicing mathematicians. Teachers helped set guidelines, select topics, and develop the model and evaluation instrument for the workshops. They assisted with identification of presenters and served on individual planning teams for each workshop. Many currently serve as teacher coordinators, ensuring that the workshop guidelines are followed. In addition, they oversee the sharing of field-tested ideas by workshop participants for inclusion in the teacher resource book which each workshop is producing.

Teacher initiative and leadership at each of the schools is also emerging. As the original three +PLUS+ departments come to grips with their own leadership problems, the lessons learned are being applied in subsequent leadership workshops for the Phase II schools. Experience, for example, has emphasized the necessity of departmental cohesion, resulting in a change of approach to the development of collaborative techniques and team building based on that cohesion.

At Manual Arts, teachers organized some activities and created their own office space. While these successes were accomplished by two individuals, their efforts were directed at improving the work situation of all of the teachers. Also, for the first time, two teachers have indicated interest in the position of department head, resulting in the need for an election.

At Wilson, six of twelve mathematics teachers are +PLUS+ members. Initial reports from Wilson indicated that, while the teachers were meeting, no one was assuming leadership. But the school year progressed, and with the beginning of the 1986-1987 school year, individual teachers began to take the initiative. The group went on a camping trip. A teacher visited Boston to learn to use the Geometric Supposer and then presented a workshop; this teacher also convinced the school to use the software in four of eight geometry classes, which required solving scheduling problems and garnering support from the principal. Another teacher was instrumental in establishing a computer room. All of these activities point to emerging leadership.

At Mountain View, the sense of department cohesion was strong before its collaborative involvement. Program participation has fostered the association of Mountain View teachers with teachers in other schools. Also, the team has sponsored several activities and, like at Wilson, more individuals have assumed such responsibilities as making presentations at conferences, and planning and conducting workshops.

MATHEMATICS FOCUS

It is difficult to ascertain how collaborative involvement during the past year has affected the teaching of mathematics. An effort has been made to provide teachers with a more enlightened view of the use of mathematics and to encourage them to bring new ideas back into their classrooms. Work with team associates at universities and industries has fostered this kind of development. Teachers have been encouraged to try the ideas presented at the fall workshops and to bring their results back to the next workshop for discussion as a means of determining the effect of collaborative activities on the classroom. The sense is, however, that while some teachers have made changes in their classroom activities, a number of others have not. The level of change may be related to the situation at each school. For example, half of the mathematics teachers at Manual Arts are teaching with emergency certification. These teachers are required to take courses to gain full certification, which detracts from the time they have available for other activities. Workshop evaluations suggest that teachers are acquiring new ideas in statistics, discrete mathematics, computer software, actuarial mathematics, and the use of manipulatives.

G. Next Steps

The Los Angeles Urban Mathematics/Science Collaborative will continue to foster teacher leadership and guidance and to concentrate on team building. The collaborative is to become a forum for addressing and meeting the needs of mathematics educators in Los Angeles County by bringing together organizations and institutions to promote the learning of mathematics and the pursuit of mathematics-related careers.

The number of departments in the +PLUS+ program will be increased from three to eight during the 1987-1988 school year. Some programs will be offered to teachers in all forty-seven targeted schools. Efforts will be directed towards making teachers aware of collaborative-sponsored activities and increasing the number of teachers who participate in them.

As planned, the annual cycle of events will involve workshops in the fall for all teachers; applications by and selection of mathematics departments to become new +PLUS+ teams; submission of Action Plans by +PLUS+ teams; and the occurrence of the activities outlined in the Action Plans, including spring collaboration workshops and summer internships. The last two sessions of the 1986-1987 workshop series are scheduled January 10 and February 21, 1987. In addition, a meeting for +PLUS+ teachers and Hughes Aircraft retirees will be conducted January 15 at Hughes Aircraft.

In addition, the collaborative will provide modems and telephone lines to access the Teacher Education and Computer Center (TECC), Math/Science, and the Space Program bulletin boards. It is hoped that this communication link will encourage and facilitate networking among +PLUS+ teachers, and among these teachers and other mathematics resources in southern California. Also, opportunities will be provided regularly for +PLUS+ department teachers to attend local, state, and national seminars and mathematics conferences.

SUMMARY REPORT:
MEMPHIS URBAN MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the Memphis Urban Mathematics Collaborative. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term intent of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during its first months have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Memphis Urban League; documents and interview information provided by the project staff; the meeting in San Francisco of representatives of all of the projects; and one site visit by the staff of the Documentation Project.

MEMPHIS URBAN MATHEMATICS COLLABORATIVE

A. Purpose

As stated in the proposal submitted to the Ford Foundation, the primary goal of the Memphis Urban Mathematics Collaborative is to promote an environment of professionalism for mathematics teachers and to assist them to broaden their horizons; to establish creative working relationships with other professionals in colleges and universities, and in business and industry; and to develop creative projects which will result in improved abilities to relate mathematical concepts to students in a functional way.

B. Context

Memphis, Tennessee, has a population of 646,356, with a racial mix that is 47 percent black and 53 percent white. School system enrollment totals 105,000, of which 72.3 percent of the students are black, and 27.7 percent are white. More than half of the families (53.9 percent) in the school system are low income. The school system is ranked twelfth in the nation in size, and forty-eighth in the nation on per-pupil expenditure, despite the recent movement of major service industries (Federal Express, Holiday Corp, International Paper) into the area.

The Memphis City Schools, under the direction of Superintendent W. W. Herenton, employs 345 mathematics teachers; 50 percent are black, and 50 percent are white. Of the 345 mathematics teachers, 321 are certified to teach mathematics; not all of these currently are teaching mathematics. Consequently, it can be surmised that at least 24 teachers are teaching mathematics who are not certified to do so. Seven of the certified teachers hold doctorate degrees, 59 have course credit beyond a master's degree, 107 hold master's degrees, and 148 hold bachelor's degrees.

The Governor of Tennessee has established a career program for teachers consisting of three steps on a career ladder. Pay increases and the opportunity to work for up to twelve months are dependent upon progressing up the ladder. Teachers at levels two or three of the career ladder who do not hold a master's degree must take three hours of coursework in an appropriate area other than education every five years. Movement up the ladder also depends upon assessment of classroom-related activities, including observation of lessons, lesson planning, and compliance with the Tennessee Instructional Model. At the higher level, hours of credit are gained for out-of-school activities related to teaching and teacher-improvement activities. The career-ladder program could impact positively on the collaborative, as it will provide an incentive for teachers to attend workshops and other activities.

Teachers' interest in collaborative programs probably will be greater if the hours count toward the 140 hours needed to advance to the next step. One specification of the new career-ladder program is that self-improvement hours do not count toward the hourly requirement for advancement.

C. Establishment of the Collaborative

The Memphis Urban League is the funding agent for the Memphis Urban Mathematics Collaborative. In May, 1986, a planning grant of $2,500 was awarded to the Memphis Urban League to convene the four-month process of designing a collaborative and preparing a proposal. The planning group consisted of representatives of the Memphis Public Schools and of the Memphis Urban League, professors and administrators from local universities, and leaders from the business community. Teachers played a major role in suggesting activities for the collaborative. The proposal was submitted September 4, 1986. The grant award on October 9, 1986, made Memphis the eleventh and final site to be funded as part of the Ford Urban Mathematics Collaborative project.

The Memphis Urban Mathematics Collaborative is comprised of and receives support from the Memphis City Schools; six universities and community colleges; and, initially, sixteen corporations, businesses, and public agencies. The relationship between the Memphis Urban League and the school system is unusually close. The superintendent of the Memphis City Schools is a former member of the Memphis Urban League Board who currently serves as a member of the Board's Committee of Advisors. Nineteen of the thirty-eight members of the Board are designated representatives of Memphis businesses. These representatives have expressed support for the collaborative and enthusiasm for the League's role. The League's Board has expressed its strong view that the project should be well coordinated with the Memphis City Schools.

The collaborative is governed by a nineteen-member Advisory Committee comprised of five mathematics professors from major colleges, one representative from the Human Services Division of a college, four from businesses, two from the school-system administration, two from the Urban League's Education Committee, and five teachers. Committee membership can be increased by majority vote of members present at a regular meeting. The Advisory Committee will oversee the project and appoint subgroups for each project activity.

Project Director Nancy Gates is a Memphis mathematics teacher and recipient of a Presidential Award for Excellence in Mathematics Teaching. She will report to Herman Ewing, the Executive Director of the Urban League, for all administrative functions, and to the Advisory Committee of the collaborative for program objectives and implementation of action plans. The project director also will organize and coordinate a committee of teachers who will act as liaisons between the Advisory Committee and all mathematics teachers in the Memphis Public Schools. This committee also will advise the project director in the recruitment and selection of teachers who will benefit directly from participation in the collaborative. It is expected that an on-site observer for the collaborative will be hired in early January.

D. Relationship with Other Local Initiatives

The Memphis Urban Mathematics Collaborative will be coordinated by the Memphis Urban League. One of the 113 affiliates of the National Urban League, the Memphis League shares the national role of advocacy for the black and the poor. The Memphis League currently operates a computer-skills training program for adults, which leads to job placements in local businesses, and an education program for parents, which informs them of local educational issues and helps them to become active and informed consumers of public education. The League considers a mathematics collaborative an additional avenue through which it can work to improve the educational opportunities of the black population in Memphis by improving the professional status and mathematical knowledge of the district's high school mathematics teachers.

Both the superintendent of schools and the director of the League have strong ties with the business community. The mathematics collaborative will be another in a series of projects that are consistent with the goals of Future Memphis, the Memphis Rotary Club, and the Adopt-A-School Program of the Memphis City Schools.

The collaborative's link to the Memphis City Schools will be the district's Division of Optional Schools/Ford Foundation Project. The director of this division is a member of the Collaborative Advisory Board and is responsible for reporting the progress and the needs of the collaborative to the Office of the School Superintendent.

E. Project Activities

Project activities to date have included the planning and production of the proposal, and the formation of the Steering Committee and its subgroups. These subgroups are responsible for developing and implementing the collaborative's activities. The Advisory Committee met on November 20, 1986, at Rhodes College, while the Internship Subcommittee met November 6, and the Speakers Bureau Subcommittee met November 10.

Teacher information-and-input meetings were held throughout the month of December at various Memphis City Schools. A total of sixty-nine teachers attended these meetings, the purpose of which was to share with teachers the goals and prospects of the collaborative and to garner information from them regarding the types of summer courses they would like, their ideas on the Resource Associate program, and any leads or contacts they may have had that could help the collaborative. One teacher said, "A majority of teachers at my school are willing to participate in this collaborative." Another said, "I believe in incorporating the businesses into the school scene. I think there is a lot of merit and opportunities with the program. There is a need for this." A third said, "The ability to experience mathematics in the workplace is a plus, as well as the time allowed to work with industry."

F. Observations

It is too early in the development of the collaborative to make substantive observations about its management or its activities. However, four aspects of the Memphis collaborative should be highlighted.

First, the collaborative's host organization is the Memphis Urban League. The League's special mission is to improve the status of the urban black population. The collaborative will benefit from a history of close cooperation between the League and the school district, which provides schooling for a student population that is 72 percent black. It will be important to document how this funding agent, which is different from the funding agents of the other collaboratives, manages to establish collaborative relationships between Memphis mathematics teachers and mathematicians in business and industry.

Second, since all other collaborative projects have had some difficulty developing a workable management scheme, it will be important to document how the management of this project evolves during the next few months, given its unique setting within the community.

Third, teachers in Memphis are under a particular set of pressures and constraints in that advancement on the career ladder is tied to acceptance of the Tennessee Instructional Model, which is based on the teachings of Dr. Madeline Hunter. Involvement in course work and other activities for self-improvement cannot be counted for career-ladder purposes. It will be interesting to see how the activities of the collaborative complement or are contrary to these notions of how to improve teaching.

Finally, the collaborative is making efforts to establish one-to-one relationships between teachers and mathematicians from the business and university communities through internships, resource associates, a speakers bureau, and efforts to support other organizations relevant to mathematics teachers.

G. Next Steps

Several activities are planned for the first year of the Memphis Urban Mathematics Collaborative.

Workshops and Grants

Summer Workshops. A subgroup from the Collaborative's Advisory Committee was selected to develop courses and workshops for mathematics teachers to be offered during the summer of 1987. The workshops, which will be taught by college and university professors, as well as selected secondary teachers, will be designed to enhance teachers' preparation in current subject areas, to increase their interest in upgrading their teaching skills, and to deepen their understanding of the mathematics content of the high school curriculum.

Teacher-Initiative Grants. Plans are underway to establish a Memphis Public Education Fund. It is anticipated that one of the Education Funds first projects will be a teacher-initiative grant program in which $200 grants for materials to implement creative activities to enrich classroom instruction will be made available to 300-400 Kindergarten through twelfth grade teachers during 1987.

Community Outreach

"Kick-Off" Dinner. A "Kick-Off" Dinner is planned for January 30, 1987, to summarize the work that has been done by the collaborative and to review the projects that will be implemented during the year. The event, which will be held at Rhodes College, will also offer an opportunity for teachers to interact with college professors and business personnel involved in the collaboration.

Summer Internships. The collaborative plans to provide summer internships with business and industry for ten mathematics teachers during 1987. Placements will involve positions in which applied mathematics is an integral element of the business activity. At the conclusion of their internships, teachers will meet to discuss ways in which their experiences can effect their teaching of mathematics. This is expected to lead to curriculum-development activities and sharing among teachers at in-service meetings during the second year.

Resource Associate Program. An Advisory Committee subgroup has been formed to develop a mentor program that will foster one-to-one relationships between teachers and college or university professors, and between teachers and mathematicians in business and industry. The program plans to identify twenty-five associates who will make a commitment to work with one or two teachers during the project year, and to provide teachers with opportunities to discuss teaching techniques, curriculum activities and business-related mathematical concepts. Five of these associations will be career-ladder positions, and out-of-school time will be credited. Efforts will be made to attract teachers at all levels of professional development. Associations are expected to begin in February.

Speaker's Bureau. The collaborative will develop a roster of speakers from universities, businesses, and the school system who will be available to speak to mathematics classes or teacher groups on a variety of topics. Teachers will receive the roster in February and will be encouraged to use this resource as they develop their teaching plans for the year.

LINK Committee. The collaborative recognizes the importance of networking teachers, college and university personnel, and business people who demonstrate interest in mathematical concepts, ideas, applications, and curriculum. The LINK Committee will identify the mathematics-based professional associations currently in operation in Memphis (i.e., regional mathematics teachers association, and the regional affiliate of the MAA), and from this will determine whether to support and strengthen an existing agency for the purpose of serving teachers or to develop a new mathematics organization.

Dissemination. The collaborative will develop a public relations program to ensure the promotion of all project activities and to serve as a link to other collaboratives in the Ford Foundation's national program.

SUMMARY REPORT:
NEW ORLEANS MATHEMATICS COLLABORATIVE (NOMC)

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the New Orleans Mathematics Collaborative. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during its first four months have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Metropolitan Area Committee Foundation; documents and interview information provided by the project staff; the meeting in San Francisco of representatives of all of the projects; a retrospective interview with Barbara Nelson of the Ford Foundation; and two site visits by the staff of the Documentation Project.

NEW ORLEANS MATHEMATICS COLLABORATIVE (NOMC)

A. Purpose

As stated in the proposal submitted to the Ford Foundation, the goal of the New Orleans Mathematics Collaborative (NOMC) is to enhance the professional development of secondary school mathematics teachers in the New Orleans Public School District and to enrich the teaching of mathematics by providing opportunities for teachers to:

1. become part of a network of mathematicians;
2. work in collaboration with mathematics teachers and other mathematicians in addressing both teacher and student needs;
3. keep abreast of developments in the fields of mathematics and teaching; and
4. experience first-hand the ways in which mathematics is used outside the academic setting.

B. Context

New Orleans is a city of approximately 536,300. The public school system reflects the unique demographics of its inner-city residents. Due to the migration of the white population in the 1950s and 1960s, the core inner city is predominantly young, poor, and black, with many families headed by single women. The increase of young mothers with school-age children, especially in the elementary grades, is a trend that is expected to grow. In fact, New Orleans has one of the highest poverty rates in the country, with twice as many families and children below the poverty level as in the country as a whole. Barely 50 percent of students entering public schools graduate from high school, with the highest number of dropouts in the ninth and tenth grades.

The superintendent of the Orleans Parish Public Schools is Dr. Everett J. Williams. There are 140 public schools, compared to 104 non-public schools (private and parochial) in the Orleans Parish. New Orleans has nineteen public high schools, of which seventeen are traditional, and two are "second chance" schools for potential dropouts. Three of the traditional high schools are vocational schools. Students who graduate from the vocational schools must meet the same academic standards as students from the other schools. The elective courses taken by students in the vocational schools generally are concentrated in one vocational area.

Fifty-six percent of the $218.7 million budget for the public schools during 1986-1987 came from state and federal funds. Funds from the district's three major sources--local, state and federal governments--are all decreasing.

In 1985-1986, there were 78,583 students enrolled in grades K-12. Of these students, 86.2 percent were black; 8.6 percent were white; and 5.2 percent were Asian, Hispanic or American Indian. Thirty percent of the students are from low-income families and are therefore eligible for Chapter I funds. Between 1979 and 1984, school enrollment decreased by nearly 3,000. It is predicted, however, that this decrease will be recovered over the next five years. The average class size is twenty-eight students in the elementary grades, and twenty-five students in the secondary grades.

In 1985-1986, there were 4,392 teachers in the Orleans Parish, 2,604, or 59 percent, of whom were black females. There are 226 mathematics teachers in the secondary schools, which include middle (grades 6 through 8), junior high (grades 7 through 9) and senior high (grades 9 through 12 or 10 through 12). Of these mathematics teachers, more than 200 are fully certified and tenured (three or more years of service). Two mathematics teachers hold doctorates, thirty-one hold masters degrees plus thirty hours, fifty-seven hold masters degrees, and 136 hold bachelor degrees. Teaching salaries range from $16,000 for a beginning teacher with a B.A. degree to $26,210 for a teacher with a doctorate degree. The nearly 130 senior high mathematics teachers will comprise the collaborative's target group.

The mathematics curriculum requirements for graduating students are one unit each in Algebra I, Algebra II, and Geometry. These courses are offered at three levels: regular, honors, and gifted. Remedial courses include Introduction to Algebra, Consumer Mathematics, and Business Mathematics. Courses for advanced students include Trigonometry, Advanced Mathematics, Calculus and College-Level Calculus. In addition, Computer Science I and II, and College-Level Advanced-Placement Computer Science are available.

Based on the mathematics scores on the Comprehensive Test of Basic Skills (CTBS) administered in 1984-1985, 37 percent of Orleans Parish students placed in the bottom quartile, and 39 percent of students fell between the twenty-fifth and fiftieth percentile. In 1985-1986, 27 percent of the students were in the bottom quartile, and 39 percent fell in the twenty-fifth to fiftieth percentile range.

The mean ACT score of the 1985 graduating class was 12.7 percent, compared to the national average of 18.6. (The possible range of scores was 1 through 36.) The Louisiana state universities, all of which have an open admission policy, require students with ACT scores lower than 16 to take remedial mathematics at the beginning of their college careers.

C. Establishment of the Collaborative

The funding agent for the New Orleans collaborative is the Metropolitan Area Committee (MAC) Foundation. The Metropolitan Area Committee is a non-profit, citizens' action organization whose membership includes representatives from business, labor, professional, academic, and religious communities in the greater New Orleans area. MAC, founded by a biracial group of community leaders in 1966, undertakes a wide range of civic and educational activities in New Orleans.

The MAC Education Fund, a project of the MAC Foundation, was established in December, 1985, with a grant from the Pittsburgh-based Public Education Fund. In fall, 1985, the Ford Foundation approached Dr. Norman Francis, president of Xavier University in New Orleans and chairman of the MAC Education Committee, with the idea of creating a mathematics collaborative in New Orleans. Dr. Francis noted that the Metropolitan Area Committee was in the process of establishing a public education fund and suggested that this would be an appropriate host agency. However, Dr. Francis felt that, because a large staff effort would be needed to establish the public education fund, the development of a collaborative should wait until the fund was established. Individuals on the MAC Education Committee proceeded to gather more information about collaboratives and to stimulate interest in the project among teachers and others in the community.

After extensive discussion with several MAC members, Barbara Nelson of the Ford Foundation met on April 29, 1986, with representatives of the MAC Education Fund board, corporations, businesses, and universities. The decision to proceed with the development of a collaborative was based on the willingness of this group's members to commit themselves to the effort. A timetable was developed and submitted to the Ford Foundation. The MAC Foundation received a three-month planning grant of $2,500. A planning group was formed, consisting of representatives of the Orleans Parish Public Schools, the teachers' union, professors and administrators from local universities, and leaders from the business community. Involving representatives from a variety of organizations in the planning process has been a key element in establishing community-wide ownership of the project. It is also believed that involvement of a wide variety of sectors has expedited the implementation of the collaborative's initial activities. On August 1, the MAC Foundation submitted a proposal to the Ford Foundation for the establishment of an urban mathematics collaborative with a start-up date of September 1.

The collaborative is comprised of and receiving support from the Orleans Parish Public Schools, the teachers' union, three universities, the Louisiana Science Centre, and six businesses and corporations. Involvement of three other universities, and additional business and community organizations is beginning to develop.

Constance Barkley, director of the MAC Education Fund, serves as the collaborative's project director. Olympia Boucree, a former mathematics teacher and supervisor, is project coordinator. Sally Hayes, executive director of MAC, also provides important administrative support. The on-site observer is Aldonia Winn, a former algebra teacher who is currently a Chapter I resource teacher.

The collaborative is governed by a steering committee of twenty members, including mathematics teachers, school-system administrators, and representatives from the teachers' union, local businesses, universities, and the Louisiana Science Centre. The chair of the Steering Committee, Dr. Richard Hays, also serves on the MAC Education Fund Board. The Steering Committee monitors and evaluates programs, and serve as a think tank to solve problems and create new initiatives. Four subcommittees have been formed to oversee each of the activity areas: symposia, site visits and internships (including university courses); workshops; and the newsletter. Each subcommittee is responsible for implementing the appropriate programs. The subcommittees also recommend modifications based on their experiences and generate ideas for new collaborative activities.

The symposia subcommittee was responsible for planning the first symposium, held in December. After the symposium, the subcommittee met to evaluate the event and to initiate plans for a second symposium. The workshop subcommittee is in the process of planning workshops to which all mathematics teachers in the New Orleans public schools will be invited. The site visit/internship subcommittee will contact companies, universities, and other institutions for a commitment to participate in hosting site visits, sponsoring an intern, and/or visiting a New Orleans public school. The newsletter subcommittee is composed of designated newsletter coordinators from the other three subcommittees. The first edition of the New Orleans Mathematics Collaborative Newsletter is planned for January, 1987.

In addition to the Steering Committee and its subcommittees, collaborative resources include the Louisiana Science Centre, the nationwide network of Ford Foundation-supported urban mathematics collaboratives, professional organizations in mathematics-related fields, and the local Association of Mathematics Teachers. An effort will be made to maintain a high community profile through effective use of the media, the collaborative newsletter, and business, university, and school-system publications.

D. Relationship with Other Local Initiatives

The MAC Education Fund, developed in 1985, is a project of MAC. The New Orleans Mathematics Collaborative is the fourth program to be coordinated by the MAC Education Fund. The other current programs of the education fund are "Partnerships in Education," "Mini-Grants for Teachers," and "Community Awareness."

The Partnerships in Education program provides an opportunity for business-and private-sector organizations to become involved in public education through concentration on the needs of an individual school. Through their partnerships, schools expand their available resources and enhance their understanding of the needs and concerns of business. During the summer of 1986, five teachers went to Fort Sill, Oklahoma, as guests of the U.S. Army to observe the mathematics the Army was using.

The mini-grant program provides teachers with the resources to explore new teaching techniques and to develop creative projects that will benefit their students. Grants of up to $500 each are awarded in the fall and spring semesters, with an implementation period of up to twelve months.

The goal of the community awareness program of the MAC Education Fund is to improve citizen awareness of the needs and challenges facing the New Orleans public schools. A program of this type is necessary in New Orleans because 80 percent of the city's households have little or no contact with the public schools. The isolation of citizens from the schools is reflected in the confusion which surrounds many public-school issues.

The newly established Louisiana Science Centre is playing a strong role in the development of the collaborative. The Centre was originally established by the New Orleans Chamber of Commerce as a project of the business community, and it is housed in one of the buildings from the 1983 World's Fair. The Centre is designed to teach basic science and mathematics to the public through thematic exhibits, coursework, and daily classes.

E. Project Activities

Opening Reception

A reception to officially launch the New Orleans Mathematics Collaborative was held November 18 at the Louisiana Science Centre. Teachers, principals and school district personnel were invited, along with the media and key representatives of the New Orleans business and university communities.

Symposia

The kick-off symposium, "Mathematics for All," took place December 4, 1986, at the Holiday Inn Crowne Plaza. Dr. Jack Cawley, professor of mathematics at the University of New Orleans, spoke on the use of mathematics. A panel discussion, involving Merle Harris, a teacher, and Jonathan Lifa of Chevron USA, followed the presentation. Attendance at this opening symposium was very good: of the 118 persons who made reservations, 106 attended. Approximately 75 percent were teachers; the remainder were representatives from businesses and universities. Seventy-four participants evaluated the first symposium; respondents included forty-six teachers, twelve business representatives, seven university professors and nine administrators. The overall evaluation was very positive. One person wrote, "We need more gatherings like this so that math teachers and business people can discuss educational issues that are of mutual interest to both groups. The discussion segment allows teachers to focus on specific mathematical needs and concerns of the business sector." Another noted, "Long overdue." A third participant observed that the symposium was "refreshing and informative."

F. Observations

Because the New Orleans collaborative is in its nascent stages of development, it is too early to make substantive comments about its activities. Two positive developments have already occurred. The first involves steps taken to enhance the mathematical focus of the collaborative's administration. Olympia Boucree was appointed project coordinator. It will be interesting to watch how additional mathematics specialists become involved. The second development relates to project management. As with all new collaboratives, the New Orleans collaborative has begun to deal with the issue of assigning responsibilities for project management.

G. Next Steps

The first edition of the collaborative's newsletter is scheduled to appear in January, with further issues planned for spring, late summer and fall 1987. Merle Harris, a mathematics teacher in one of the Parish schools will edit the newsletter, which will help to keep teachers and the community informed of collaborative developments. It will also provide a forum for teachers, as well as a means of providing information on business-related mathematics developments.

In December, the collaborative sponsored a very successful symposium. The second symposium is tentatively scheduled for April, 1987.

The workshop subcommittee is working with the Louisiana Science Centre in planning five-day and one-day workshops. All mathematics teachers the New Orleans public schools will be invited to participate. The first workshop will be a one-day event in February, 1987. The topic has not yet been finalized. Long-range plans include a joint effort between subcommittee members and the Louisiana Science Centre to establish a mathematics resource center.

The site visitation/internship subcommittee is in the process of arranging site visits, which are scheduled to begin in February, 1987. The committee is also contacting companies and universities to arrange for internships for summer, 1987. These organizations are being asked to act as sponsors at a cost of $3,000 per intern.

SUMMARY REPORT:
PHILADELPHIA MATH SCIENCE COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the Philadelphia Math Science Collaborative. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Philadelphia Math Science Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco of representatives of all of the projects; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

PHILADELPHIA MATH SCIENCE COLLABORATIVE

A. Purpose

Philadelphia is a community with a rich array of opportunities for teachers, particularly mathematics teachers, to both experience individual professional growth and participate in collective activities. The mathematics teachers, however, have not always taken full advantage of these opportunities. The purpose of the Philadelphia Math Science Collaborative is to promote teacher leadership and team building, and to contribute to an understanding of a vision of mathematics teaching for the future. These activities are viewed as an initial step toward the goals of promoting change and empowering teachers to make needed changes.

The specific goals of the Philadelphia Math Science Collaborative are:

1. to develop, evaluate and document the position of an in-school collaborator who would be responsible for increasing communication among teachers, including across disciplines, and for serving as a catalyst for innovation and change;

2. to increase teacher participation in extramural professional development programs which offer:

   a. partnerships between teachers and their colleagues in academia and industry;

   b. opportunities to enhance and improve knowledge, skills and professionalism; and

   c. new ideas and opportunities for mathematics instruction, including integration of mathematics and the sciences, and use of calculators and computers to teach mathematics and science; and

3. to develop a model for documenting and evaluating the impact of both the in-school mathematics collaborator's activities and teacher participation in extramural programs on the quality of teachers' professional lives, with close attention to the role of teachers as leaders and problem solvers.

B. Context

The School District of Philadelphia is a large urban district, with a total enrollment of approximately 198,000 students, 73 percent of whom are members of a racial minority. A significant number of these students come from families who live at or below the poverty level or who are otherwise socially disadvantaged.

In September, 1986, Dr. Constance E. Clayton began her fourth year as superintendent of the School District of Philadelphia. She reported that during the past three years, an equal opportunity has been provided to all students through a balanced and focused curriculum. She also said that her administration has been successful in balancing the district budget and in increasing the confidence that parents and financial, corporate, and educational communities have exhibited toward the schools. Dr. Claytan supports the "Focus On Instruction" as the district's major initiative for the 1986-1987 school year. This initiative will provide the framework for a number of programs to improve the school district's instructional program.

A new effort to eliminate teacher shortages in special areas, including mathematics, was begun in 1986-1987. Fourteen non-teaching district employees (classroom aides, secretaries, non-teaching assistants, and stock clerks) were given classroom positions after completing a professional certification program. To be eligible for this program, non-instructional employees must have a bachelor's degree from an accredited college or university; enroll in a professional certification program at their own expense; take at least two semester hours each year toward completion of certification requirements; and apply for an emergency or interim certificate.

The school district continues to use a mandated mathematics curriculum and a systemwide student-promotion program. The secondary-mathematics-course documents were revised during the 1985-1986 school year and were given to teachers in the fall of 1986. Standard secondary mathematics courses are General Mathematics I and II, Algebra I and II, Geometry, Mathematics in Application, Elementary Functions, and Calculus. Marking guidelines for the promotion program recommend that final grades be based: 60 percent on teacher-made tests, 10 percent on city-wide midterm and final examinations, 15 percent on classwork, and 15 percent on homework assignments. A student should master at least 80 percent of the course objectives taught during the marking period to receive an "A" or "B." In conjunction with the new promotion policy, the school district offered summer school to freshmen, sophomores and juniors in 1986 for the first time in 17 years; prior to 1986, the summer school program was restricted to seniors. Of the 9,000 students in grades 9 through 12 who attended summer school, two-thirds were promoted because of successful completion of a course. Thus, as standards increase in the three-year phase-in of the systemwide promotion program, summer school has resulted in a retention rate that has remained constant.

The Secondary School Mathematics Curriculum Committee (SSMCC) plays a major role in specifying the mathematics curriculum in Philadelphia. The committee meets four times each year, although its working subcommittees meet more frequently; it is comprised of administrators, instructional leaders, mathematics teachers and mathematics educators concerned with the mathematics programs in grades 7 through 12 in the School District of Philadelphia. The committee reviews programmatic conditions and makes recommendations concerning program generation or program modifications (i.e., content, objectives, instructional support, articulation between or among courses/program, and document format). It is in this manner that local district curriculum is shaped.

A wide array of programs are available to teachers in Philadelphia. They include those sponsored by the Philadelphia Renaissance in Science and Mathematics (PRISM), The Association of Teachers of Mathematics of Philadelphia and Vicinity (ATMOPAV), and several area colleges and universities. In addition, the Division of Mathematics of the School District of Philadelphia sponsors a number of activities and coordinates activities developed by others.

C. Development of the Collaborative

The collaborative was originally established in fall, 1984, under the name Philadelphia Mathematics Collaborative (PMC). During the 1985-1986 school year, it became obvious that PMC was experiencing difficulty. Specifically, two main problems were hampering the growth of the collaborative. The first was conceptual: On what basis could the collaborative establish a program of activities within the context of the rich array of opportunities already available to mathematics teachers in Philadelphia? Many of the activities initiated by the urban mathematics collaboratives in other cities already were available through PRIME, PRISM, ATMOPAV, and other organizations. PMC's two primary activities involved cosponsoring a Summer Institute and paying for ATMOPAV membership; while these were valuable, it was felt they did not constitute a program upon which a long-term collaborative project could be based.

The second problem was managerial. The collaborative needed a coordinator with the energy and the vision to set up a reasonable program of activities. Furthermore, since both the Institute and the collaborative's director are strong in science rather than mathematics, conceptual help with respect to mathematics also was needed. However, budget constraints and the Institute's salary schedule prohibited hiring a project coordinator with all the necessary qualifications; the person who was hired proved unable to provide the needed leadership.

Aware of this situation, Barbara Nelson of the Ford Foundation met in February, 1986, with Joel Bloom, director of the Franklin Institute, and Wayne Ransom, director of education programs for the Franklin Institute and of the Philadelphia Mathematics Collaborative. After considerable discussion, it was agreed that the collaborative would apply for continued funding on the conditions that: (1) it focused its efforts on a targeted number of schools; (2) the proposal for continued funding address how the collaborative would relate to the other activities already available in Philadelphia; and (3) the collaborative encompassed science as well as mathematics. In fall, 1986, the Philadelphia Mathematics Collaborative was renamed the Philadelphia Math Science Collaborative. Wayne Ransom continued as the director of the restructured math/science collaborative.

Following the resignation of Mr. Herb Isakoff, who had been project coordinator during the 1985-1986 school year, Ms. Sue Stetzer assumed the coordinator's position in October, 1986. An experienced mathematics teacher and department head in the Philadelphia district, Ms. Stetzer is well known to teachers and administrators. She has been active in ATMOPAV and in the collaborative. Until her appointment as coordinator, Ms. Stetzer was the on-site observer of the collaborative for the UMC Documentation Project; that position was filled by Ms. Joyce Neff, a high-school mathematics teacher in the Philadelphia schools.

The Philadelphia Math Science Collaborative has focused its activities on six secondary schools. The decision to limit the project to six high schools was based on a desire to establish an identity in the face of the many other activities already available to teachers in the Philadelphia area. A collaborative involving all schools would be viewed as identical to many other such projects; a collaborative which initially involves only six schools does not experience pressure to develop large scale activities, but can work on a small scale to develop strategies to get teachers involved in programs already available. Restricting the initial efforts of the collaborative to six schools thus facilitates project management and makes it easier to find schools that are committed to the concept.

The six target schools for the Philadelphia Math Science Collaborative and each school's student enrollment, are: Murrell Dobbins Vocational-Technology (2,065); Martin L. King (2,131); Overbrook (2,367); Roxborough (1,540); Thomas Edison (2,030); and West Philadelphia (1,761). All are inner-city schools. The student population at four of the schools is nearly all black. At Roxborough, 47 percent of the students are black, and 51 percent of the students are white. At Edison, 35 percent of the students are black, 59 percent of the students are Hispanic, and 6 percent of the students are white. Of the students who graduate from these six schools, 30 to 40 percent plan to go on to some form of higher education, 5 to 10 percent plan to go into the military, and 5 to 40 percent plan to work. On average, about one-third of the teachers at each high school are black, and two-thirds are white. Two of the high schools have one or two Hispanic teachers. The number of mathematics teachers at each school ranges from ten to fifteen; the number of science teachers ranges from six to fifteen.

Four of six target schools operate on an abbreviated daily schedule. Consequently, there is no lunch period, and school is dismissed at 1:18 p.m. This type of schedule increases teachers' isolation both by making brown-bag lunch seminars impossible and by reducing the probability of these teachers participating in after-school programs (which usually start at 4:00 p.m.).

On June 16, 1986, the collaborative held a recruitment meeting to which principals and science and mathematics department heads from the six target schools were invited. The schools were chosen by David Williams, Director of the Division of Mathematics for the School District of Philadelphia, and represented typical inner-city schools. These particular schools were selected because their mathematics department heads had already participated in a PRISM-sponsored program. Also in attendance were Dr. Williams; Dr. Francis Betts III, the executive director of PRISM; Don Steinberg, the director of the Division of Science for the School District of Philadelphia; Wayne Ransom, the director of education programs for the Franklin Institute and of the Philadelphia Math Science Collaborative project; Sue Stetzer, future coordinator of the Philadelphia Math Science Collaborative; and Joyce Neff, who was to become the on-site observer for the UMC Documentation Project.

At the meeting, Sue Stetzer outlined the goals of the collaborative and the services the Philadelphia Math Science Collaborative expected to offer to participating schools. These services included: professional consultations and secretarial help in the preparation of PRISM mini-grants; facilitation of exploration of curricular areas of common concern in joint mathematics-science department meetings; help in identifying and obtaining speakers from business, industry, and the academic community; and support for teachers in areas in which they identify specific professional needs. In exchange for these services, each participating school was asked to agree: to hold a minimum of two or three joint math-science department meetings during the 1986-1987 school year; to provide access for the collaborative coordinator to attend department meetings and to meet with mathematics and/or science teachers individually or in groups; and to support the goals of the collaborative.

The general response at the meeting was favorable. The mathematics department heads knew Sue Stetzer well and were generally receptive. The science department heads, on the other hand, tended to be somewhat skeptical. At the meeting, a letter of agreement was distributed, and the principals and department heads were asked to return the signed copy of the agreement by June 26, indicating their willingness to participate. All were returned.

The Advisory Council was formed in fall, 1986, replacing the Administrative Coordinating Committee which had existed the first year of the collaborative project. Initially, the Advisory Council was comprised of eighteen members. Six teachers on the council represent the six target schools and the directors of Mathematics and of Science represent the school district. Other members of the council include Dr. Francis Betts and Elizabeth Haslem (PRISM), Joyce Neff (ATMOPAV), Dr. Alex Tobin (PRIME), and representatives of the Philadelphia Secondary Science Association, Drexel University, SIAM, the community college, the electric company, Sun Oil, Philadelphia Federation of Teachers, and PECO. The council's purpose is to provide support to the coordinator and direction for the collaborative by helping to evaluate and reshape existing programs, as well as designing new programs. The council is scheduled to meet after school once every other month.

The first meeting of the Advisory Council was held October 28. Thirteen members attended. Sue Stetzer reviewed the history and purpose of the collaborative. Wayne Ransom described the council's role as one of helping to identify opportunities for teachers and providing direction for the collaborative. The council discussed existing programs and their relationships to the collaborative. Members in attendance felt the meeting was worthwhile and appreciated the diversity of the group. A few participants expressed a "wait-and-see-what-develops attitude," while others began to identify people who should also be involved.
Following the first meeting, the Advisory Council membership was expanded to include additional representatives from the school district, as well as from colleges and universities.

The second meeting of the Advisory Council was held December 17 at the Franklin Institute. Eighteen people attended. The agenda included a report on collaborative activities and a lengthy discussion of the Professional Enrichment Grants (PEGs). These grants are available to high school mathematics and science teachers to attend professional conferences and workshops. Frank Betts of PRISM offered up to $1,200 to match the collaborative's funds for grants to teachers in non-targeted schools. The meeting was productive and participants appreciated that everyone was allowed to participate in the discussion. Because the meeting went so well, everyone was very encouraged about the future of the collaborative.

D. Relationship with Other Local Initiatives

There are several important organizations in Philadelphia whose activities have a direct bearing on the support of mathematics and science teachers in the city and, therefore, impact directly on the activities of this project. They include the Franklin Institute (the funding agency); the Committee to Support Philadelphia Public Schools (CSPPS); the Philadelphia Renaissance in Science and Mathematics Education (PRISM); the Philadelphia Regional Introduction for Minorities and Education (PRIME); and the Association of Teachers of Mathematics of Philadelphia and Vicinity (ATMOPAV).

The Franklin Institute has a 150-year history of promoting science and technology. As the region's only science and technology center, the Institute has valuable expertise to apply to the improvement of science and mathematics education. It has been a pioneer in the area of experimental education, including hands-on exhibits, resource materials and kits, and has conducted seminal work in evaluating the effectiveness of exhibits and other informal teaching media. The Franklin Institute has a strong tradition of cooperative relationships with other organizations in the private and public sectors and has been deeply involved in new initiatives in mathematics and science teacher training.

The Committee to Support Philadelphia Public Schools (CSPPS) was started more than three years ago as an organization comprised of high-level corporate, higher education, and foundation executives. The CSPPS has approximately $2.5 million available to support teaching programs; the committee established a humanities task force, and initiated the Philadelphia Renaissance in Science and Mathematics (PRISM).

The Philadelphia Renaissance in Science and Mathematics (PRISM) is an alliance of educational and cultural institutions, governmental agencies, corporations, the Philadelphia Federation of Teachers, and the School District of Philadelphia. PRISM's purposes are to stimulate interest in science and mathematics education, to assist teachers in increasing the effectiveness of instruction in science and mathematics, and to support the efforts of the school district to increase enrollment in these areas. PRISM's activities are primarily developmental in character, intended to increase resources available for instruction in mathematics and science through the creation of programs which have the potential to become financially independent. A small professional staff consults on program design and financing, and monitors quality control in PRISM-supported programs. PRISM is not a foundation and, therefore, neither solicits funding from the public nor provides total funding for any single program. Programs supported by PRISM, in addition to the collaborative, include the Teachers Advisory Group, PRISM Institute, the PATHS/PRISM Mini-Grants, PRIME, the Math/Science Clearinghouse, PTIP (Philadelphia Teacher in Industry Program), and PRISM Colloquia.

PRISM was relatively new when the Philadelphia Math Science Collaborative was formed. Since then, PRISM has been reorganized in order to coordinate a broad range of activities. The organization became more structured in February, 1986, with the appointment of Dr. Francis M. Betts as executive director.

In April, 1986, PRISM formed a Teachers Advisory Group (TAG). Teachers are appointed to the group through nomination by the school district, the Philadelphia Federation of Teachers, and area professional associations of teachers in science and mathematics. The group serves as an advisory body to PRISM in planning new programs, evaluating ongoing programs, and communicating with practitioners in the field. Each TAG member will work closely with one PRISM project in both an advisory and leadership capacity, thereby joining with representatives of the school district, cultural and educational institutions and corporations on program advisory boards.

The Philadelphia Regional Introduction for Minorities and Education (PRIME), was established in 1972 at the initiative of General Electric. PRIME has been active in supporting improvements in school mathematics and has expanded its interest from engineering to other areas such as pharmacology and actuarial work. PRIME consists of thirty-two businesses, seven colleges, nine environmental organizations and two school districts, Philadelphia and Camden. Two thousand children participate in its programs, with 450 in summer programs. PRIME had two initial goals: the first was to garner commitments from the district regarding staff development for higher levels of mathematics. The second was to combine informal programs through the Franklin Institute and other agencies with formal programs and professional societies to improve what they saw as poor communications between the colleges and schools. It was believed that PRIME could act as a catalyst because of its independence.

The Association of Teachers of Mathematics of Philadelphia and Vicinity (ATMOPAV), has an active membership of approximately 650 high school and college mathematics teachers. It provides regular programs and a newsletter.

Six institutions of higher education in the Philadelphia area have offered cost-free course auditing during the 1986-1987 school year for Philadelphia public school teachers involved in PRISM and PATH programs. The courses are offered to enable teachers to strengthen their professional growth in science, mathematics and the humanities. The sponsoring institutions are the University of Pennsylvania, Community College of Philadelphia, Villanova University, Bryn Mawr College, Beaver College and Chestnut Hill College.

E. Project Activities

One goal of the Philadelphia Math Science Collaborative is to increase teacher participation in the many professional-development programs offered in the Philadelphia area; during 1986, a wide array of such programs and activities were available to secondary mathematics teachers. The majority of these events were planned by the Committee to Support Philadelphia Schools (CSPPS), the Philadelphia Renaissance in Science and Mathematics (PRISM), the Franklin Institute, the Division of Mathematics of the School District of Philadelphia, and the Association of Teachers of Mathematics of Philadelphia (ATMOPAV). The collaborative supported these related activities by publicizing the events and, in a few cases, providing some funds to partially pay for the event or to allow teachers to attend. These activities are described in the "Related Activities" section.

In addition to the related activities, the Philadelphia Math Science Collaborative sponsors activities of its own that are intended primarily for teachers from the six targeted schools. The collaborative organizes these activities, funds them, and handles publicity. These activities are described below in the "Collaborative Activities" section.

RELATED ACTIVITIES

Computer Applied Instructional Training Program

Between October, 1985, and February, 1986, a workshop series was conducted by the Office of Continuing Professional Education of Drexel University. The series was held for the School District of Philadelphia and was funded by the Committee to Support Philadelphia Public Schools, PRISM and the Ben Franklin Partnership Program. The series was open to all mathematics and science department heads. As an outcome of the workshops, Ben Franklin grants were awarded to the mathematics departments of nine Philadelphia high schools.

1986 Summer Institutes

During 1986, PRISM sponsored three Summer Institutes for Philadelphia Mathematics Teachers. Each Institute combined theory (often taught by a college faculty member) and classroom applications (taught by a Philadelphia School District administrator). The participants received a modest stipend and an allowance to cover the cost of books, materials, and tuition. Each participant earned six graduate credit hours.

Eighteen teachers participated in the first of the three Institutes, which was held at Chestnut Hill College. The two graduate-level courses taught were "Topics in Calculus" and "Methods and Technology in Teaching Calculus."

The second institute was held at Drexel University. Seventeen teachers took the three courses offered: "Introduction to Analysis," "Special Topics in Mathematics," and "Special Topics in Computer Sciences." (This Institute was very similar to the 1985 Institute that had been cosponsored by the collaborative.)

PRISM's final 1986 Summer Institute, also held at Drexel, was an intensive two-week workshop on computer applications. Fifty-nine teachers from the nine high schools that had been awarded the Ben Franklin grants participated in the program. The School District of Philadelphia loaned each team member a computer for home use during the summer. PRISM equipped the computers with telephone modems to enable the teachers to connect to PRISM's electronic bulletin board, "High Tech Talk." The workshop proved to be the first telecommunications experience for many of the teachers.

All three Institutes appeared to be very successful. Dr. David Williams observed: "This is a stimulating, rigorous experience for teachers; they work very hard, enjoy it, while improving themselves professionally." The Director of PRISM, Dr. Francis Betts, said, "PRISM Summer Institutes enable teachers to learn both up-to-date information in math and computers and also how to apply this to the classroom. And the camaraderie and creativity generated by the institutes translates directly into renewed enthusiasm when the teachers return to their classrooms in the fall."

Philadelphia Teachers in Industry Program (PTIP)

The Philadelphia Teachers in Industry Program, sponsors teachers' participation in a nine-week fellowship for professional development that combines full-time summer employment in industry, university-level courses, and teaching-materials development. The program's ultimate goal is that teachers will take knowledge gained in the workplace back into the classroom. The PTIP fellowship program begins with a full-time placement at a host corporation. In the second phase, teacher-fellows move on to a university campus, where they work on translating their industry experience into educational materials. Finally, the materials are taken back into the classroom, field tested, evaluated, and prepared for dissemination. Up to six semester hours of graduate-level credit may be obtained. PTIP teacher-fellows receive a stipend approximately equal to that which could be earned through summer employment.

One junior-high mathematics teacher who completed a fellowship said, "Half the challenge of the field experience is learning how to learn. I mastered dBase III from a tutorial package on my own the first year. By doing this, and by learning how to meet project deadlines with few directives, I gained a new view of applied learning theory, which I can pass on to my students."

Structured Problem Solving and Microcomputer Decision Support Workshop

This professional-development workshop series sponsored by the Philadelphia Teacher in Industry Program (PTIP) was designed to introduce participants to structured problem-solving techniques and their implementation using microcomputers. The series emphasized formulating problems, identifying appropriate techniques, and understanding the microcomputer as a problem-solving tool. The ten-session series began Wednesday, March 5, and ended Wednesday, May 7. The workshop series was presented by Dr. Francis M. Betts III, executive director of PRISM.

Mathematics In Application Workshop

On May 10,1986, the Division of Mathematics Education sponsored a five-hour staff-development workshop for teachers of secondary mathematics at the Regional Computer Resource Center at Textile University. The first fifty teachers to apply were admitted to the workshop which focused on effective implementation of the course, "Mathematics in Application," and emphasized the use of available technology, problem solving, and data interpretation. All participants were involved in two sessions: one featuring hands-on use of calculators and computers, and the other involving effective strategies for teaching problem solving and interpreting data. There was no cost for the workshop and each participating teacher received approximately $100 worth of instructional resource materials and software. The division intends to repeat the workshop.

Secondary Mathematics Symposia

This series, sponsored by the Division of Mathematics Education of the School District of Philadelphia, was designed to provide teachers of mathematics with the opportunity to hear leading mathematicians and mathematics educators speak. Each month, from October, 1985, to May, 1986, a symposium was held at a local college or university. The evening included a reception, a speaker's presentation, a question-and-answer period, and an informal discussion. Speakers and their topics for the 1985-1986 symposia included: Richard Polis, Dean of Graduate Studies at Beaver College, on "Isomorphic Groups Using Braids"; Dave Glatzer, mathematics supervisor from West Orange, New Jersey, on "Teaching Percent"; Dr. Peter Hagis of Temple University, on "Number Theory: Perfect Numbers"; Jim Rubillo of Bucks County Community College, on "Can You Believe the Gallup Poll?"; Sigfried Haenisch of Trenton State College, on "Introducing Non-Euclidean Geometry in High School"; and Dr. Jesse Rudnick of Temple University, on "The Process of Problem Solving." Although attendance was light, those who did attend assessed the speakers very favorably.

Appleworks Staff Development Workshop

The School District of Philadelphia and Sun Oil sponsored a five-week training program in the use of the Appleworks Software package. On-site training by Sun Company personnel was offered after school one day each week to twenty to thirty teachers from each of five senior high schools during the months of April and

May. In fall, 1986, the workshop series was repeated several times. In addition to personnel from the Sun Company, employees of Smith Kline & Beckman, Signa, and Mellon Bank participated. During 1986, such training was offered to teachers in twenty-eight senior high schools.

Instructional Program Review Day

On June 3, 1986, a curriculum-review day was scheduled by the Philadelphia School District for all teachers and staff. The in-service day was scheduled as part of Superintendent Clayton's commitment to involving staff throughout the system in improving the curriculum, testing, pacing, and marketing of programs. Teachers and other school-district staff spent the day discussing curriculum review and staff development; teachers throughout the city made recommendations for improving the curriculum, and reviewed city-wide tests, pacing, and marketing guidelines. In June, these staff recommendations were distributed; in late September, plans were announced for implementing them.

Retreats for Department Heads

On April 16, the Division of Mathematics Education of the School District of Philadelphia held the second of two retreats scheduled for the 1985-1986 school year. The purpose of the retreat, held at the Wharton Sinkler Conference Center, was to provide leadership training in management and supervisory skills. It was believed that effective leadership was a prerequisite to implementing the district's initiatives in standardized curriculum, curriculum-referenced testing, and curriculum development and revisions. The retreat provided a valuable opportunity for building networks between the department heads.

Beaver College Mathematics Colloquia

A mathematics colloquia series was sponsored by Beaver College and funded by the Education for Economic Security Act. To date, three colloquia have been held. Speakers included: Dr. David Williams, who spoke May 1 on "Calculators in the Classroom"; and Dr. James Rubillo, chairman of the Mathematics Department at Bucks County Community College, who spoke June 3 on "The Mathematics That Teachers Should Know." Prof. Sigfried Haenisch of Trenton State College spoke at the third symposium, which was held in September. Colloquia are open to all teachers of mathematics and to students of Beaver College.

High Tech Talk (HTT)

High Tech Talk, PRISM's electronic mail bulletin board and teleconferencing system, was tested in early 1986 and came on-line 24 hours a day in May. The system operates out of the PRISM office in the United Engineers Building. HTT is viewed as a means of linking educators with their industrial counterparts through a rapid, convenient, and inexpensive means of communication. The system is available to all Philadelphia mathematics and science teachers. PRISM will aggregate teachers' individual orders for modems and communication software in order that teachers can benefit from a bulk discount purchase price. In the summer of 1986, PRISM acquired fifty modems for distribution to teachers participating in the PRISM Summer Institute on Computer Applications in Teaching. In the fall, the modems and software were redistributed to math and science departments for use in instructional support.

High Tech Talk provides a variety of services to science and mathematics teachers. The main menu lists the following sub-menus: Administration; Bulletin Boards; Clearinghouse--PRISM's Information Center; List of HTT Members; Electronic Mail; Problem Solving; University and College Information; and Special Interest Groups. Among the information included under "Bulletin Boards" are activities of professional societies, public domain software, and Swap Shop. "Clearinghouse" includes the complete Philadelphia Math/Science Resource Catalog (which lists twenty-one field-trip sites dealing with science and mathematics), plus a calendar of professional programs. The Electronic Mail Section allows users to leave messages for one another, including pages of text. The Problem Solver's Corner encourages professional level communication on scientific, technical and pedagogic issues. The Philadelphia Math Science Collaborative hopes to encourage ongoing communication between the target schools through High Tech Talk and has, therefore, established its own bulletin board on the system. It is anticipated that the teachers will use it to share ideas and objectives.

Currently, more than 100 teachers are using HTT, including some from the collaborative's target schools. Those teachers who participated in the Summer Institute appear to be the most active users.

ATMOPAV Meetings

Winter Meeting. More than 200 teachers attended the ATMOPAV Winter Meeting on February 22, 1986, at Temple University. The theme of the conference was "Uniting Industry, Technology, and Mathematics." This program was unique among ATMOPAV conferences in its effort to relate teaching to the outside world. The keynote address was presented by a teacher who left teaching to work in industry, missed teaching, and returned to the classroom. Sessions were also conducted by Alex Tobin on PRIME and Frank Betts on PTIP. During the conference, the annual high school student mathematics contest was held. Information about the contest was sent to 230 high schools in the Philadelphia area; eighty high school students from twenty-seven schools participated. Each school was allowed to enter three students, and the five top scoring schools were awarded plaques.

The conference was very successful. High attendance (more than 100 attendees above the average) was attributed to the event's central location, to the good weather, and to attendance by approximately seventy-five student teachers. The participants seemed to enjoy themselves and appeared pleased with the diversity of offerings and level of performance in the sessions. One teacher said, "The speakers spoke from their experiences and shared things that can be used. The workshop on language arts and math was particularly helpful. Math has beauty and we should help develop our students' critical thinking." Another said, "This was a really needed event for networking of teachers. For some teachers, this is the only professional information they get." A professor of mathematics from Westchester University said, "I was very pleased with the turnout and the response of people to the student contest."

The Philadelphia Mathematics Collaborative helped to facilitate holding the conference at Temple University and has been a motivating force in establishing a close alliance between ATMOPAV and Temple.

Spring meeting. The annual ATMOPAV Spring Banquet was held on May 8, 1986, at Dunfey's. Before dinner, a panel discussion on software pirating entitled "Copyright or Wrong," was presented. Dr. Max Sobel, the past president of NCTM, gave the keynote address. Dr. Sobel received an award in recognition of his outstanding contributions to mathematics.

Sixty-seven people attended--a somewhat low figure in light of the 1,000 members of ATMOPAV. In general, however, the event, which is primarily social, was viewed as a success. A department head who attended commented, "The activity was worthwhile. The panel discussion was very informative and very applicable to what we do. The weakness was poor attendance." A university professor who had attended said, "This is a nice event. It's a shame that more people didn't come." One teacher commented, "I enjoyed meeting other math teachers. I would like to get more involved in ATMOPAV and this was a good beginning." Other comments were, "Networking is great. Getting together with other teachers is a tremendously exciting thing. The speaker was charming. We needed more people to be there, especially since everybody's a member."

Fall meeting. The ATMOPAV Fall Meeting was held Saturday, October 25, 1986, at the Philadelphia College of Textile and Sciences; the meeting's theme was "Mathematics: Today and Tomorrow." As part of the day-long meeting, the collaborative sponsored a luncheon.

Teachers from the collaborative who attended appreciated the speakers but were somewhat overwhelmed by the number of concurrent sessions. Ninety people attended the luncheon, including members of the collaborative, speakers, members of the ATMOPAV board, and past presidents of ATMPOPAV. This was a good opportunity for the teachers to socialize with one another and to exchange ideas.

Available Newsletters

A variety of newsletters were distributed in 1986 to the secondary school mathematics teachers of the Philadelphia School District. Among these were: "Philadelphia Humanities," the PATHS newsletter; "Refractions," the PRISM newsletter; "Communique," published by the Committee to Support Philadelphia Public Schools; PSST Newsletter, published by the Philadelphia Secondary Science Teachers; the "ATMOPAV Newsletter," published by the Association of Teachers of Mathematics of Philadelphia and Vicinity; and the newsletter published by the School District of Philadelphia. In fall, 1986, PATH and PRISM published a joint newsletter, "Continuum," consolidating their two separate newsletters. This newsletter, which will be published six times each year, will disseminate information about opportunities for teacher development, including information about the Philadelphia Math Science Collaborative. The ATMOPAV Newsletter, which is published three times each year, also promotes activities for and provides information about the Philadelphia Math Science Collaborative. The editor of the ATMOPAV newsletter is Sue Stetzer, the coordinator of the collaborative project. In addition, the collaborative has developed its own newsletter which is explained in more detail below.

COLLABORATIVE ACTIVITIES

Reunion for the 1985 Summer Urban Teacher Institutes

In summer 1985, the collaborative initiated a Summer Institute on mathematics that was codeveloped with PRIME (Philadelphia Regional Introduction of Minorities in Engineering). On February 25, 1986, the collaborative, the School District of Philadelphia and PRIME cosponsored a reunion for those who had participated in either the 1985 Summer Institute at Drexel or in other Urban Teacher Institutes at Andover-Dartmouth. Twenty-four people, including nine of the original eighteen teachers who had participated in the 1985 Drexel Summer Institute, attended the reunion, which was held at the Franklin Institute. At the reunion, Dr. Mark Driscoll from the Technical Assistance Project at the Education Development Center presented some general ideas on mathematics education. Dr. Alexander Tobin, the executive director of PRIME, discussed plans for a "repeat" Summer Institute to be held in 1986, and Dr. David Williams, director of mathematics education for the School District of Philadelphia, discussed preliminary plans for an "advanced" Summer Institute to be held at Chestnut Hill College.

The teachers at the reunion seemed very pleased to see one another and the reunion had a collegial atmosphere. One of the students from the 1986 Summer Institute talked about how she had "actually done math homework on the subway," something that she had never done before. She said, "We lived and breathed mathematics for four weeks with time out only to sleep and eat." One of the instructors from the 1985 Institute said that the class "was so extraordinary that no class could ever compare to them." He said he hoped that the 1985 participants would spread the word and act as ambassadors for the 1986 Institute. The on-site observer for the UMC Documentation Project commented, "The meeting was very valuable. It provided a means for people who had worked very closely together for four weeks last summer to come together, catch up on what they were doing, reestablish connections, and find out about the summer program for this summer in enough time to plan accordingly. The relationship between the participants and their teachers from last summer was also warm and strong. There is evidence of a lot of personal bonding, as well as a strong allegiance to the program and its future."

Mini-grants

The collaborative provides Professional Enrichment Grants (PEG) to high school mathematics and science teachers in Philadelphia public schools to attend professional meetings, workshops, and seminars. The collaborative has $4,800 to offer to teachers from the target schools, plus an additional $1,200 earmarked for teachers in non-target schools. In addition, PRISM has offered to match the $1,200 stipend to non-target schools. Grants are to focus on the general area of professional development. The collaborative has budgeted $400 for each department within each school; individual grants may not exceed $250. Interested teachers are to submit a completed application form to Sue Stetzer at least thirty days prior to the event or meeting for which funding is being requested. Teachers from the six targeted schools are given priority. As a result of the PEG program, eight teachers will receive grants from the collaborative to attend the KEY mathematics conference at Host Farms March 13 through March 15, 1987. In addition, fifteen teachers from the target schools will receive funds from the school district to attend the conference.

The Philadelphia Math Science Collaborative also supported mini-grants from other sources by providing in-service and consultation to teachers in preparing the proposals. During the 1985-1986 school year, PRISM awarded forty-three mini-grants to teachers or to groups of teachers to support innovative and experimental projects designed to enrich classroom experiences in mathematics and/or science. Grants of $300 were made to individual teachers, while groups of teachers who collaborated on a project received up to $3,000. A mini-grant fair was held November 12 at which projects funded by mini-grants were highlighted. To date, sixteen PRISM mini-grants have been awarded for the 1986-1987 school year, three of which were to high school mathematics teachers.

During the 1986-1987 school year, the collaborative will make a concerted effort to assist teachers in the six target schools in applying for mini-grants. The coordinator will meet with teachers to help them identify and develop program ideas, as well as to provide technical support (including typing) for the grant request. In order to encourage further applications, a session on writing mini-grant applications, led by PRISM's documenter, Elizabeth Haslem, was held for mathematics department heads in December.

Department Meetings

Each mathematics and science department is directed by the school district to hold a monthly meeting; these generally occur on the second or fourth Tuesday of each month. In line with its goal that mathematics and science teachers interact on a more regular basis, the collaborative has required that at least half of the department meetings are held jointly.

The collaborative's impact on these department meetings has been felt in a variety of ways. For example, the collaborative has been instrumental in arranging for some of the joint department meetings to be held at the Franklin Institute. On October 24, twenty-five teachers from Dobbins Area Vocational Technical School met at the Franklin Institute. Participants commented that it was the first time that the mathematics and science teachers had an opportunity for formal interaction. This, along with the information they received about the Franklin Institute, made the meeting very worthwhile.

On December 9, a joint meeting of the mathematics and science departments of Edison High School was held at the Franklin Institute. Eighteen teachers from Edison were given a thirty-minute tour of the Institute's newly reopened mathematics exhibit. Teacher reactions to the meeting were very positive.

At West Philadelphia High School, college and university professors have spoken to department meetings on problem solving and other current issues in mathematics. These presentations were funded by a mini-grant from PRISM; the department head had applied for the money as a result of her involvement with the collaborative.

At Edison, Overbrook and Roxborough high schools, speakers have presented sessions on mathematics in applications. At a joint meeting of the mathematics and science departments of Roxborough High School on December 2, Dr. Miriam Yevick of Rutgers University discussed her book, Mathematics for the Billions. Twenty-four teachers attended this presentation; while they felt that some concrete applications of mathematics were offered, their general response was that the talk was not as valuable as it could have been.

As a result of collaborative encouragement, departments also have met together to review computer software. The science department at West Philadelphia High School met November 25, the science department at Martin Luther King High School met December 1 through December 3, and the science department at Dobbins High School met December 5 to review software.

When possible, the collaborative coordinator, Sue Stetzer, attends department meetings. At these meetings, she has worked with teachers on a needs assessment, which included documenting the "base line" which represented the current level of activities of teachers in both "in-school" and "out-of-school" activities. She has also provided assistance to teachers in developing objectives for the school year.

Dues to Professional Organizations

In the 1985-1986 school year, the Philadelphia Mathematics Collaborative paid the ATMOPAV membership fee for every Philadelphia public high school mathematics teacher, increasing the organization's membership by about 250. In the 1986-1987 school year, the collaborative is paying the membership fee for all the mathematics teachers in the six target high schools. The collaborative is also paying the membership fee to the Philadelphia Secondary Science Teachers Association for the science teachers in those six schools.

Philadelphia Math Science Collaborative Newsletter

Sue Stetzer, coordinator of the Philadelphia Math Science Collaborative, edits a monthly newsletter which is sent to the mathematics and science teachers in the six targeted schools. Copies of the newsletter also are sent to the principals, and mathematics and science department heads in all high schools in the district.

The first issue of the newsletter, published in November, 1986, described the collaborative and PRISM. The newsletter explained that the collaborative is trying to determine what can be done to make the teacher's job easier. Programs designed to reduce isolation of teachers and to increase collaboration with their peers in the business, industrial, and academic communities were listed. The newsletter also included a calendar of relevant events in November and a questionnaire to indicate what teachers would like to see the collaborative doing. Responses to the questionnaire included "desire for involvement with industries," "reduce work load by not having to write school plans," and "open communications between mathematics and science teachers."

The December issue of the newsletter reported on the collaborative's change of name from the Philadelphia Mathematics Collaborative to the Philadelphia Math Science Collaborative. It also included an announcement of coming events and informed teachers of the Mathematics in Applications Network.

"Meet the Directors" Meeting

On December 3, a social event was held to enable mathematics and science teachers in the district to meet the school district's director of mathematics and director of science. Forty teachers, six from the targeted schools, attended the event at the Franklin Institute. The meeting was viewed as a success; teachers enjoyed getting together with one another as much as meeting the directors. Dave Williams, the director of Mathematics Education, was so pleased that he suggested such a gathering be held monthly.

Mathematics in Applications Networks

In fall, 1986, the collaborative initiated plans to establish a teachers' network in mathematics in applications. This network will attempt to distribute public-domain software and teacher-written templates to be used with Appleworks and the Graphics Department. Teachers will be the primary source of materials for the network. An article in the December issue of the collaborative newsletter requested teachers to submit to Sue Stetzer ideas, software they have developed, or activities they have prepared. In early 1987, eighty-five copies of software and an accompanying twenty-page booklet describing teacher activities will be distributed to mathematics department heads and to all teachers of the course "Mathematics in Applications." In addition to the materials, ACCESS, a newsletter which lists resources and sample activities, will be circulated.

Clearinghouse

Related to the establishment of the Mathematics in Applications Network, the PMSC also provides a clearinghouse service to teachers in its target schools by keeping these teachers notified of resources for classroom use. In the December issue of the PMSC newsletter, teachers were informed of two video cassettes they can get free of charge from a project sponsored by Phillips Petroleum Company. The two video cassettes include seven programs about mathematics and problem solving. Another resource available was the loan of energy-related computer software, compatible with the Apple IIe, from the Philadelphia Electric Company.

F. Observations

The Philadelphia Math Science Collaborative has made great strides since it was reformulated in the latter half of 1986. Discussion of the collaborative's growth will focus on four major issues: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

The Philadelphia Math Science Collaborative experienced two problems in its first year of operation which led to the project's restructuring of the collaborative. The first, a conceptual problem, focused on the ways in which the collaborative could relate to other initiatives while maintaining a unique character within the local educational context. The second problem involved project leadership.

The conceptual problem appears to have been solved. The Philadelphia Math Science Collaborative has identified a set of activities for each target school that best utilizes available resources for in-school development.

The leadership problem that deterred the development of the collaborative also appears to have been solved. Sue Stetzer has brought both the needed vision and the energy to the Philadelphia Math Science Collaborative. She is on leave from her position as a department chair for this academic year, and is being paid by the Philadelphia School District. The Franklin Institute is reimbursing the school district, thereby providing the funds to pay the salary of the teacher who is teaching in Ms. Stetzer's place. Plans are underway to enable her to remain as the coordinator on a permanent basis; this is seen as a significant development, as her leadership has been very important to the vitality of the collaborative.

COLLABORATION

It is too early to evaluate the degree of collaboration in the Philadelphia Math Science Collaborative due to its recent restructuring. The emphasis on six target schools introduces a new element into support activities in Philadelphia. The activities provided through PRISM and the Committee to support Philadelphia Public Schools are supported by, but developed separately from, the collaborative. Because of the number of existing activities, the collaborative has made a conscious decision to support these activities and to encourage the participation of teachers from the targeted schools, rather than to initiate activities.

It is clear, however, that the collaborative has begun to wield subtle effects on the context within which it operates. For example, as a result of contacts established through the Philadelphia Math Science Collaborative, ATMOPAV and Temple University have worked closely together in organizing the association's annual meeting on that campus. This is the second time since the collaborative was established that a university has offered ATMOPAV facilities. In 1985, Drexel had made a similar gesture.

PROFESSIONALISM

The collaborative's strategy has been to focus on inter-departmental collaboration and to help teachers decide which activities they feel would be most productive. For example, the collaborative has supported teachers' efforts to seek mini-grants; in this case, the grants came from outside resources but the initiative for teachers to submit a proposal came from their association with the collaborative. As a result, some teachers are beginning to feel like participants in the decision-making process.

As teachers within a school work together to take greater advantage of outside resources and activities, the potential exists that the nature of the collaborative's offerings will change. What goes on within the schools will impact upon what future activities will be offered and what dynamics will be used to encourage teachers to participate in those activities.

This will be one site where the relationship between the teachers in the target schools and the bureaucratic demands of the school district, such as the mandated curricula, will warrant careful observation during the next few years. As teachers in these schools gain power and collaboratively develop improved programs within schools, they undoubtedly will confront the need to challenge current curriculum policies. The ways in which such challenges are negotiated within the Philadelphia schools should be of interest to the Ford Foundation and others interested in curricular and institutional change.

MATHEMATICS FOCUS

The collaborative has been active in providing teachers with a broader sense of mathematics. An emphasis has been placed on department meeting presentations that stress problem solving and mathematics applications. An effort has also been made to provide teachers with software so that computers can be used more effectively in mathematics instruction. In addition, the collaborative has encouraged and even helped to facilitate teachers' attendance at professional meetings. Teachers' attendance at professional mathematics education meetings will keep them current on issues in mathematics education. It is too early to predict the impact that these experiences will have on classroom teaching. It will be interesting to see how the new ideas to which teachers are exposed are integrated into the mandated curriculum. What is evident is that the Philadelphia Math Science Collaborative has taken great strides toward a more enlightened view of mathematics.

G. Next Steps

The immediate concern of the Philadelphia Math Science Collaborative is the establishment of close ties with the six target schools. With the reformulation of the collaborative, the focus has shifted from mathematics, to linking mathematics and science departments. The collaborative will continue to arrange joint departmental meetings within each school to foster the exchange of concerns, ideas, and information. The collaborative also will continue to promote dialogue among the mathematics and science teachers in the six targeted schools. Next year, the number of targeted schools will be increased to nine.

The collaborative will continue to organize "Meet the Directors" sessions. It is felt that these meetings give mathematics and science teachers the opportunity to become better acquainted with the district's curriculum directors, as well as with one another.

The collaborative will continue to develop ACCESS, the Math in Application Network that it initiated in fall, 1986. Additional software will be distributed as teachers submit materials. The collaborative is considering establishing a similar network for science software.

In order to encourage teachers to attend professional conferences, the Philadelphia Math Science Collaborative will provide funds for some teachers to attend meetings such as those of the Pennsylvania Council of Teachers of Mathematics, NCTM and NSTA. The collaborative will pay for eight teachers to attend the KEY mathematics conference at Host Forms on March 13 through March 15, 1987.

PRISM sponsors an ongoing curriculum forum on a variety of topics for grades K-12. In March, 1987, this forum will focus on mathematics in applications. The coordinator of the collaborative will help organize and support this forum; PRISM, however, will provide all of the funds.

During summer, 1987, local colleges will offer short courses or Institutes. A short course on calculus will be held at Chestnut Hill, a course on discrete mathematics will be held at Beaver College, and a Woodrow Wilson Institute on statistics, cosponsored by the collaborative, will be held at the community college.

Business-school alliances are being explored in order to build networks between mathematics teachers in the target schools and others associated with the use of mathematics. To date, the local energy company and two other local corporations have been approached.

SUMMARY REPORT:
PITTSBURGH MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the Pittsburgh Mathematics Collaborative. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Pittsburgh Mathematics Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco of representatives of all of the projects; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

PITTSBURGH MATHEMATICS COLLABORATIVE

A. Purpose

The six goals articulated in the initial proposal for the Pittsburgh Mathematics Collaborative continue to provide focus for the collaborative. The project's goals are:

1. to overcome teachers' isolation and to increase opportunities for interaction;
2. to educate the community about the professional nature of high school mathematics teachers;
3. to enhance teachers' knowledge base of mathematics applications;
4. to provide opportunities for professional self-enhancement;
5. to provide opportunities for teacher recognition; and
6. to provide time for teacher interaction, work, and professional development.

The long-range goal of the collaborative, as stated in the 1986 proposal for continued funding, is the institutionalization of a set of structures and processes that will continuously foster teacher professionalism and will be decreasingly reliant on external administration and facilitation. Attainment of this goal is partially dependent upon the identification of resources to cover ongoing program costs. In light of this goal, collaborative activities are guided by a vision that by 1990, Pittsburgh will have:

1. an energized secondary mathematics faculty, deeply involved in mathematics curricular and policy issues, and continuously interacting with the larger community;
2. a more broadly based community that is knowledgeable about secondary mathematics issues and appreciative of secondary teachers;
3. a series of mechanisms in place to promote exchange and interaction among teachers and community leaders in business, industry, and higher education; and
4. a public more aware of the importance of mathematics in students' educational development and in adults' professional lives.

B. Context

The Pittsburgh metropolitan area has a population of 2.5 million people. The city itself has a population in excess of 400,000. The area is served by the Pittsburgh Public Schools District. The superintendent is Dr. Richard Wallace, Jr. who has held the position since the 1980-1981 academic year. The central office support for curriculum areas was reorganized at the start of the 1985-1986 academic year. In February, 1986, as a result of the reorganization, Dr. Diane Briars was appointed to the newly created position of the Associate Director for Mathematics.

A school closure program is nearing completion. The district serves approximately 40,000 Kindergarten through twelfth-grade students. Of the student population, 52 percent are black and 48 percent are white, with other groups not being significantly represented. The district is organized into 48 elementary (K-5), 16 middle (6-8) and 12 high schools (9-12). Good relations exist between the superintendent's office and the local teachers' union.

There are 126 high school mathematics teachers. Of these, ten are black. All 126 teachers are fully certified to teach mathematics and average 20 years experience in the classroom. There has been no recruiting for some years, as the district's population has declined. Teaching positions will soon open as teachers on this maturing teaching force retire.

In the fall of 1985, teachers received a three-year contract. In January, 1986, Superintendent Wallace secured a four-year contract. Together, these contracts will help to ensure stability in school district working conditions through 1988.

Two new district initiatives have received the superintendent's support. The first involves dispersion of authority to a wider group within the district. The second is the implementation of some of the "effective schools" procedures, including the PRISM (Pittsburgh Research-based Instructional Supervisory Model) program. This program, designed to improve instructional and evaluation techniques, is based on an adaptation of Madeline Hunter's Effective Teaching Model. PRISM, which has been in effect in the district since 1981, began with the training of administrators. Principals and department chairs are among those being trained to perform teacher observations and evaluations.

Since 1981, the school district also has implemented the Monitoring Achievement in Pittsburgh (MAP) program, an instructional testing system designed to increase student achievement in basic skills. Components of MAP include the identification of skill expectations, focused instruction, monitoring achievement, appropriate instructional resources, time on task, and staff development. The MAP Mathematics Program covers objectives for grades one through eight, General Math, Algebra I and II, Geometry I, and Consumer Math. All students mainstreamed in these grades and courses take multiple choice tests on twenty to thirty-one objectives at each level; one test item is used for each objective. The tests are computer scored, and the results are reported on the Class Diagnostic Summary and the Student Achievement Report.

The district has actively addressed its declining enrollments and its desegregation plan. Two high schools have been merged into one for the 1986-1987 school year, reducing the number of high schools in the district to twelve. Magnet schools provide a means of voluntary desegregation. The value of some magnet programs became evident in November, 1986, when parents waited in lines in below-freezing temperatures for more than four days to register students in magnet middle and high school programs.

C. Development of the Collaborative

The Pittsburgh Mathematics Collaborative is administrated by Coordinator Dr. Leslie Salmon-Cox, and Assistant Coordinator Dr. Martina Jacobs. Dr. Salmon-Cox is affiliated with the Learning Research and Development Center at the University of Pittsburgh. Dr. Jacobs works with the Allegheny Conference on Community Development. Dr. Diane Briars, the school district's new Associate Director for Mathematics, provides a major link between the collaborative and the district. The on-site observer is Ms. Rosemarie Kavanagh, who is a retired mathematics teacher. Dr. Salmon-Cox, Dr. Jacobs, and Dr. Briars meet the first Tuesday of each month with Mrs. Nancy Bunt, the local education coordinator for the Allegheny Conference on Community Development, and Mrs. Jeanne Berdik of the Partnerships in Education Program, to review plans and coordinate activities. This group is referred to as the "First Tuesday Committee."

Collaborative governance is shared among the Steering Committee and its Executive Committee, both of which were actively involved in writing the initial proposal, and a group comprised of the department chairs from each of the high schools. The Steering Committee meets once or twice annually to discuss the direction and activities of the collaborative. The department chairs meet monthly throughout the school year to work on specific activities, such as content for a third year general mathematics course. The department chairs are the major communication channel between the collaborative's administration and the teachers. In 1985-1986, there were thirteen department chairs; the merging of two high schools in 1986-1987 reduced the group to twelve. Both the regional supervisor and Diane Briars work closely with the department chairs. As a result of its activities during the first year of the collaborative and of the interaction between the coordinator of the collaborative and the school district administration, the department chair group has increased in status within the district and is now referred to as the Mathematics Communication Advisory Group.

Steering Committee

The twenty-nine member Steering Committee includes three representatives from the school district administration; four teachers; three representatives from universities; one from a community college; five from institutes and foundations; five from community councils; five from corporations; one from the Buhl Science Center; one from the Federation of Teachers; and the collaborative director. The Steering Committee met once during the 1985-1986 school year. At that meeting, held March 12, participants discussed ways to acquaint teachers with the mathematics that non-college bound students will need to work in local industries. Collaborative activities were summarized. Ideas discussed included teacher participation in industry-sponsored training programs, classroom visits by speakers to demonstrate the use of mathematics in business and industry, and a program in which teachers train new employees in industries. It was suggested that the teachers meet regularly without an agenda so that discussion can be responsive to problems. Committee members felt that the meeting stressed the importance of coordinating the needs of industry to the education of future employees.

The Steering Committee met December 11, 1986; at the meeting the coordinators reviewed the collaborative's accomplishments and current goals. Concerns included students' failure to understand the need for mathematics and the consequent low enrollment in mathematics classes, and disinterest in the collaborative by some teachers in the district. In response, the committee suggested that the collaborative should air mathematics programs on WQED, the educational television channel, and encourage teachers to meet as a group over dinner. The committee also discussed involving all high school mathematics teachers in the collaborative and the potential future scarcity of mathematics teachers in Pittsburgh. It was noted that middle school teachers would like to be involved in the collaborative; the Ford Foundation's funding conditions that limit their participation were explained, and ways that middle school teachers may participate in some activities were suggested. Participants suggested pairing high school and middle school teachers for classroom visits. The committee felt that meeting more often than twice each year was unnecessary unless a particular need arose.

Mathematics Department Chairs Meeting

The mathematics chairpersons from each high school met five times during the 1985-1986 school year and summer. The meetings were designed to organize the collaborative, to open communication channels, and to provide a substantive anchor for establishing the collaborative.

Thirteen chairpersons, the associate superintendent of the Pittsburgh Public Schools, a member of the mathematics faculty of the University of Pittsburgh, and the collaborative's administrators attended an introductory meeting on November 1 and 2, 1985; the event included dinner and a presentation on discrete mathematics Friday evening and a workshop Saturday morning. Workshop participants discussed the intent of the Pittsburgh Mathematics Collaborative and the needs of its chairpersons and of its members. Tom Romberg of the Documentation Project spoke on the Urban Mathematics Collaborative project, and Martina Jacobs spoke on mathematics and the work place. Chairpersons identified several needs, including learning more about mathematics applications, having more options for non-college bound students, and having teachers more involved in the decision making that affected their daily lives as mathematics teachers.

The second chairpersons' meeting was held January 24, 1986, at Allderdice High School as part of an all-city inservice workshop. The discussion of collaborative goals and needs was continued, the group identified those issues it wished to raise with Dr. Wallace in February.

The third chairpersons' meeting was held February 18, 1986. Leslie Salmon-Cox was instrumental in arranging to have Superintendent Richard Wallace attend the meeting and in obtaining his permission for the group to discuss the curriculum for the third year of mathematics instruction, a program motivated by a new requirement passed by the Pennsylvania State Legislature. Assistant Superintendent Stan Herman also attended. The meeting was considered significant in that important issues were identified and Superintendent Wallace participated. In addition, this was the first opportunity for Dr. Briars, who had started with the district the day before, to meet the committee.

As a follow-up to the February 18 meeting, the department chairs met at the Project EQ (Equity) conference to discuss designing the mathematics curriculum along the EQ guidelines. While this meeting was not sponsored by the collaborative, it did correspond to the work initiated at the group's last meeting.

On Monday, March 17, 1986, the department chairpersons met formally for the fourth time. Drs. Briars, Salmon-Cox, and Jacobs attended. Topics discussed included computers and calculators in the classrooms; mathematics placement; and the content of the third year of mathematics in high school for non-academic students, in particular as it addresses the needs of minorities.

The fifth meeting of the department chairpersons was held Saturday, April 26, 1986, at the Learning Research and Development Center, University of Pittsburgh. The agenda involved formulating recommendations to guidance counselors for making the appropriate placement of students in mathematics courses, and initiating plans to prepare calculator-assisted portions of the mathematics courses. Eleven chairpersons, as well as Drs. Briars, Salmon-Cox, and

Jacobs, attended. The chairpersons were divided into two groups, and each group was assigned one of the agenda topics; they worked to develop a detailed guide for proper placement of students in mathematics classes, a draft of a calculator policy statement, and a plan to redesign the general mathematics courses.

The chairpersons felt the meeting was productive and that a spirit of camaraderie was developing among the members of the group. There was a sense that something was finally happening--they were discussing important issues and being allowed input into district activities. They reported that teachers were interested and ready to become involved in the collaborative.

On Monday, July 7, 1986, the chairpersons met for the sixth time. Drs. Briars and Salmon-Cox reviewed the progress made by the collaborative during the school year and highlighted items for the fall. They reported that a placement guide to help counselors place students in mathematics classes had been developed and that calculators had been ordered. The group agreed that each department would decide how best to disseminate the calculators within each school. A district-wide policy will be developed in the spring of 1987.

Over the year, the group of department chairs evolved from individuals who had never met together into a close working group. They continued to meet regularly, with meetings held September 17, October 30, November 17, and December 18.

Principals Meeting

As a means toward improving collaborative credibility within the district, Dr. Salmon-Cox and Dr. Briars met with the high school principals to describe their work with the department chairs. Initially, the principals did not express much enthusiasm for the collaborative. Since then, however, as a result of Dr. Salmon-Cox's personal contacts with individual principals and the support of the district administration, the principals have developed a greater appreciation for the collaborative's work.

D. Relationship with Other Local Initiatives

The Pittsburgh Mathematics Collaborative has been designed to build upon local initiatives. The collaborative's work is integrated with the initiatives of the Pittsburgh Public Schools, the Allegheny Conference on Community Development (ACCD), Education Fund, Partnerships in Education program, local universities, vocational training programs, and other community-based programs.

The Pittsburgh Mathematics Collaborative engages in joint projects with the public schools which work toward attaining the district's goals: curriculum reform, establishing mathematics resource centers, computer literacy training for teachers, increment credit course development, and pilot testing of textbooks. In these joint projects, the Pittsburgh Mathematics Collaborative supports the activities, organizes many of them, facilitates those organized jointly with district personnel, and is instrumental in obtaining outreach funding, such as in the case of computer training.

Through the Allegheny Conference on Community Development, and the Partnerships in Education Program, the collaborative establishes contacts with representatives of business and industry. The collaborative capitalizes on existing relationships between corporations and schools, enlisting support from corporations interested in mathematics education. Programs are arranged whereby corporations sponsor site visits for mathematics teachers. At these inservice programs, teachers receive information about the corporation, important future directions and job areas, and the mathematics required to perform these jobs. Dialogue regarding mathematics preparation is encouraged between teachers and corporate representatives.

The Pittsburgh Mathematics Collaborative strives to foster a positive and accepting environment at local universities for the benefit of high school mathematics teachers; the collaborative's goal is to develop a collegial relationship characterized by mutual respect between teachers and university faculty.

The collaborative has cooperated with the University of Pittsburgh in writing a proposal to create six tuition-free fellowships for secondary mathematics teachers to enroll in graduate level courses. The proposal awaits final approval of the new university provost, who is yet to be appointed. The collaborative and the University of Pittsburgh also have discussed developing joint mentoring programs for student teachers in mathematics, and the role of the collaborative in a program to recruit bright undergraduates to careers in teaching. Plans are underway to work with other institutions of higher education in the Pittsburgh area.

E. Project Activities

During 1986, all of Pittsburgh's 126 secondary mathematics teachers had the opportunity to participate in a variety of collaborative activities, including a reception, seminars, computer training, curriculum development involving the use of calculators, and tours of local industry; many of the tours were held on designated teacher inservice days. These activities are described below in the section "Collaborative Activities."

The collaborative also supported teachers to take advantage of professional opportunities offered by related organizations. These included attendance at professional meetings and at a lecture series, as well as applications for professional enrichment grants. These activities are described in the section "Related Activities."

During the 1985-1986 school year, teacher participation was voluntary. Beginning in September, 1986, however, six mandatory inservice days, two for each of the three clusters of schools, were allocated for collaboration activities. It should be noted that the Pittsburgh Mathematics Collaborative project was established after the district's calendar had been set for the 1985-1986 school year; as a result all the inservice time had already been allotted. Because teachers were reluctant to leave their classrooms, all collaborative activities during the 1985-1986 school year were scheduled after school, on free days, or on weekends. Attendance at collaborative activities was notably higher during the 1986-1987 school year, as a result of the activities having been scheduled on inservice days.

COLLABORATIVE ACTIVITIES

Collaborative Reception

On Monday, June 16, 1986, a reception for Barbara Nelson of the Ford Foundation was held in the U.S. Steel Building to celebrate the first year of the Pittsburgh Mathematics Collaborative. Fifty-nine people attended, including teachers, representatives from business and industry, and university faculty. Barbara Nelson gave a comprehensive review of the activities of the other collaboratives. Leslie Salmon-Cox provided a summary of the year's activities of the Pittsburgh Collaborative. In addition to the presentations, the reception provided an opportunity for those who have been a part of the collaborative to socialize. A short meeting with the department chairpersons was held prior to the reception so that they could share with Ms. Nelson their thoughts regarding various mathematics issues and their ideas regarding the future of the collaborative.

Seminar on Customized Job Training Programs

On Friday, April 18, 1986, a seminar "Customized Job Training: Meeting Local Industry's Needs for Qualified Workers" was held at the Community College of Allegheny County. Twenty-two teachers from Pittsburgh Public Schools, fifteen teachers from the county, and twenty-four teachers from the community college attended. The collaborative funded the attendance of the PPS teachers, including dinner and mileage.

The seminar focused on the educational skills necessary for non-college-bound students to succeed in the work place. The first presentation, sponsored by Mellon Bank, focused on job training; the second, sponsored by Shandon Southern Instruments, a medical equipment manufacturer, discussed the needs of future employers. The Mellon Bank representative reported on an employee retraining program for persons whose jobs had been assumed by machines. She noted that the bank provided software training to enable employees to improve their skills, including mathematics skills. The Shandon Southern Instruments representative reported that their non-college employees were required to manipulate percents, to operate a calculator accurately, to convert one liquid measure to another, to use ratios, and to apply a given formula. Every applicant must pass a timed test to be considered for employment. AS a follow-up to the program, the speaker sent teachers a sample of the kinds of problems an employee would be expected to solve.

Teachers who attended the seminar felt it was a good beginning toward a cooperative effort between industry and schools, that there was a need for more such programs, and that future programs should be more specific in focus.

RIDC High Technology Tour

On Friday, May 2, 1986, a High Technology tour of the Regional Industrial Development Corporation (RIDC) Industrial Park was conducted from 8:30 a.m. to 3:00 p.m. All secondary mathematics teachers were invited. Thirteen teachers, four mathematics supervisors, and nine others, including the collaborative coordinators and a parent representative from the high technology magnet, participated. The collaborative paid all costs, including meals and mileage. The tour visited the Contraves Goerz Corporation, designers and manufacturers of measuring instruments, industrial controls, and machinery; International Cybernetics Corporation/Gould Incorporated (ICC), developers of microprocessor-based controls and other technology for factory automation; and the Emblematics Corporation, providers of individualized consulting, research, instruction, and intelligent systems software design. Timothy Parks, Executive Director of the Pittsburgh High Technology Council, spoke at the luncheon on "High Technology and the Implication for Mathematics Instruction."

Teachers who attended spoke positively about their experience. One teacher commented, "I think that today's experience was personally very gratifying and, for the first time, I have a little knowledge about the mathematics needed to take advantage of the jobs offered in the present and future." Other comments included: "The information was useful but it shows me how far my students will have to go to be useful in the high tech fields"; "I have better knowledge of what high tech industries are"; and "Students graduating from high school today are not ready to work in a high tech industry. Two years of technical school preparation after they have the basic skills [are needed]." In general, the teachers felt that the meeting was quite educational and credited the collaborative with providing the opportunity.

Computer Training

In August, 1986, the Pittsburgh Mathematics Collaboration received a $20,000 challenge grant from the Pennsylvania Ben Franklin Partnership Program to train a select group of secondary mathematics teachers to become computer literate. The project will train ten teachers to use computers in teaching mathematics; these teachers then will instruct their peers. Next summer, ten teachers will spend 120 hours becoming experts in the uses of computers to teach mathematics.

Calculator Curriculum Planning

For one week during the summer of 1986, six teachers worked with Diane Briars to develop district plans for the use of regular and scientific calculators in general mathematics courses. This activity was funded by the collaborative. During the 1986-1987 school year, teachers will be asked to provide feedback on the plans.

Inservice Programs

Equibank Tour. The collaborative arranged for a tour of the Equibank Headquarters on Friday, October 3, 1986, as an inservice day for a cluster of three high schools. The activity allowed teachers to discuss various banking operations and their mathematics applications and implications with the staff and management of Equibank. Twenty-five teachers, seven supervisors, and two collaborative representatives attended. The bank president and a senior vice president responded to teachers' questions. The executives noted that the commercial phase of business needs employees with college degrees in credit analysis and accounting, while the consumer phase requires employees to possess skills which emphasize addition, subtraction, multiplication, division, and percentages. The president agreed to provide a sample of the test that is given to applicants and sample problems that could be used in the classroom. A reception followed the tour and discussion session.

Westinghouse Nuclear Training Center Tour. On Thursday, October 9, 1986, a half day inservice enabled the mathematics teachers of five high schools to tour the Westinghouse Nuclear Training Center. The tour provided information about the mathematics that is required for various careers in the nuclear energy field. Two managers and an engineer reviewed the skills required for employment in the nuclear power industry. The teachers viewed training materials, including models of nuclear components and a control room simulator. It was difficult to complete the activity in the two-and-a-half hours provided. Tour evaluations were very positive. Teachers' comments on the most valuable lesson they had learned included: "the need for advanced mathematics and science courses in entry level positions"; the need to continue to teach fractions and the traditional measurement system"; "service opportunities offered to graduating seniors are not to be overlooked"; and "stressing math teaching is important--made me feel more valuable as a math teacher."

Presentation by Blue Cross. On Wednesday, October 24, at a half-day secondary inservice, representatives from Blue Cross presented a discussion of spread sheets and their applications to work. All secondary mathematics teachers were required to attend the inservice; the Blue Cross presentation was just one of a menu of choices that was offered. Also on this day, Jerry Smith, who went to Exeter in the summer, gave a workshop on the materials covered at Exeter.

RELATED ACTIVITIES

Professional Meetings and Conferences

Pennsylvania Council of Teachers of Mathematics. The Pennsylvania Council of Teachers of Mathematics met Thursday, March 13, 1986, at the Greentree Marriott. The collaborative offered to pay the cost of registration and of the luncheon for all Pittsburgh secondary mathematics teachers. Twenty-six teachers attended the meeting, which provided them an opportunity to meet and discuss their concerns, to be exposed to new ideas and approaches to teaching mathematics, and to hear informative speakers. Sessions covered such topics as "Creating Opportunities for Minorities in Mathematics-Based Professions" and "Initiating Computer Use in General Mathematics."

National Council of Teachers of Mathematics. Two collaborative representatives, Dr. Briars, and a mathematics supervisor attended the April 2-5 annual meeting of the National Council of Teachers of Mathematics in Washington, D.C. Expenses were paid by the collaborative.

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy. During the summer of 1986, the Technical Assistance Project at the Education Development Center funded a teacher to participate in a week-long conference at Phillips Exeter

Academy in New Hampshire. The conference focused on the impact and application of the computer on the curriculum. Among the topics discussed were discrete mathematics, new developments in mathematics, and issues in mathematics education.

Educator-in-Residence Lecture Series

During 1986, the Alleghany Conference Education Fund sponsored a lecture series. The first lecture in the series was held on Tuesday, April 8, 1986. Educators and industrialists met to socialize and to hear an address by Saul Hurwitz of the Committee for Economic Development. The meeting was held in the U.S. Steel Building. Highlights of the talk included a discussion of the role of education in producing good citizens, the role of business in shaping education and public policy toward business, and employability. Dr. Hurwitz stressed that positive relationships and interaction between business and schools are needed. He indicated that the structure of private- and public-sector partnerships must change so that the commitment of people from the top down can be reflected. A question and answer session followed Dr. Hurwitz' presentation.

A second program in the Educator-in-Residence Lecture Series was held August 21, 1986. Al Shanker, President of the American Federation of Teachers, gave a presentation on the Carnegie Foundation Report on "Teaching, A Nation Prepared." This presentation, held at the U.S. Steel Building, was sponsored by the Allegheny Conference Education Fund. Teachers, principals, administrators, Partnership-in-Education coordinators, and corporate representatives attended. Mr. Shanker noted that, as a result of teacher lay-offs and their low salaries as compared with comparable jobs in industry, only 6 percent of current college students are interested in teaching. He predicted that unless salary scales and working conditions are improved, and class size is decreased, 50 percent of current teachers will leave the profession.

The Changing World of Academia and Work

On Monday, September 29, a presentation on economic forecasting was held in cooperation with the Changing World of Academia and Work Project (a program for counselors) at the Station Square. Carol Monaghan, Director of the Economic Development Committee, Allegheny Conference on Community Development, presented an overview of Pittsburgh's shifting economy. A film, produced by Duquesne Light Company, described changing economic conditions from the 1700's to the present. The film prompted a discussion, and dinner was provided. Attendance was voluntary. Fifty-six mathematics teachers and forty-two counselors from the Pittsburgh and county schools participated.

Professional Enrichment Grants

In fall, 1986, the collaborative announced the availability of Professional Enrichment Grants for high school mathematics teachers. The grants, available through the Allegheny Conference Education Fund, provide teachers with an opportunity to attend professional meetings, workshops and seminars, and to consult with fellow teachers and colleagues in the private sector. Individual grants may total up to $300. Teachers must submit grant requests sixty days before the event or meeting for which funding is being sought.

F. Observations

During 1986, the Pittsburgh Mathematics Collaborative continued to make great strides. The collaborative's growth in four specific areas will be addressed: Project Management, Collaboration, Teacher Professionalism and Mathematics Focus.

PROJECT MANAGEMENT

There is a very close, tripartite working relationship between Dr. Salmon-Cox, the coordinator of the collaborative project; Dr. Jacobs, the assistant coordinator; and Dr. Briars, the school district's Associate Director of Mathematics. The three are in constant contact and, based on fairly clearly defined areas of responsibility, share much of the decision-making. Together with a member of the Alleghany Conference staff and a representative of the Partnerships in Education Program, they constitute "the First Tuesday Committee," a title derived from the committee's meeting schedule. The First Tuesday Committee is responsible for many collaborative decisions, including the scope of the collaborative's activities and the selection of participants in those activities. The committee meets regularly to ensure coordination across the represented group.

There are three elements of the project's administrative organization that require comment. First, the direct involvement of Dr. Salmon-Cox in the day-to-day organizational and intellectual aspects of the project is unique among her counterparts in the other collaboratives. Second, the direct involvement of the school district has enabled the collaborative to develop activities, which address the problems and priorities of the district. This has from the outset provided the conditions for the establishment of ownership among teachers and administrators in the success of the project. Third, the complementary skills and knowledge of the three central planners has been reflected in the distribution of collaborative tasks and responsibilities.

Of primary concern to the collaborative over the next two years will be the institutionalization of structures and processes that will continue beyond the period that the collaborative is funded by the Ford Foundation. In addressing this concern, great care has been taken to ensure that all planning involves the Associate Director for Mathematics, the department chairs, and the Steering Committee. In this sense, the collaborative acts not as a director, but rather as a facilitator whose role is to organize activity, to garner resources, and to establish new interactions and networks.

COLLABORATION

Efforts have been made to establish political connections between the collaborative and the district by gaining the support of key people and by keeping them informed; among these key contacts are principals and the president of the Pittsburgh Federation of Teachers. These connections facilitate the collaborative's efforts to provide recognition for teachers and opportunities for interaction. The assistant coordinator has made a considerable number of contacts with industries and businesses in the area as a means of providing the collaborative with a strong community link. Representatives from business, industry, and the higher education community who have participated in collaborative activities are reported to be extremely positive about the programs and the opportunities to talk with teachers.

The Pittsburgh Mathematics Collaborative is well linked to the district through the Associate Director of Mathematics and other collaborative participants who serve on various district committees. The coordinator of the collaborative has chosen to work through the department chairs, to gain their support, and to increase their status in the district; the strategy has proven effective in that department chairs have formed a group whose members value meeting regularly. In turn, the district has granted this group greater responsibility for the mathematics curriculum--a change in district structure that could remain for some time. It is assumed that a strong department-chair group can be used to draw in all the mathematics teachers. The collaborative has been successful in involving other mathematics teachers in curriculum revision task forces, as well as in conferences such as that held at Exeter.

TEACHER PROFESSIONALISM

In light of the constraints inherent in holding activities during non-school time, the administrators of the collaborative project were pleased with the level of teacher participation during this first year of the collaborative. Evaluations of the 1985-1986 activities indicate that the greatest enthusiasm is evident among the chairpersons, who were most heavily involved this first year. The reaction of other participants also has been enthusiastic. Non-participating teachers who have received information on collaborative activities have indicated that they would be interested in participating if the events were scheduled during inservice time. Progress in collaborative outreach is expected in 1986-1987 because the district will require every teacher to attend two collaborative-sponsored inservices.

The department chairs have exhibited an enhanced sense of professionalism, evident in their increased confidence and in their willingness to address substantive issues. Equally important is the district's recognition of this professionalism, evidenced by the increased level of responsibility it has assigned to the group. This group cohesion and district recognition are the results of collaborative efforts; in particular, the collaborative coordinator made initial efforts to meet with individual department chairs, and, in some cases, with the entire department to initiate activities and to lay the groundwork upon which the department chairs could build.

Several initiatives of the school district will relate directly to achieving collaborative goals. While teachers are coming under more restricted district supervision through increased observations and evaluations, the collaborative's goal involves formation of structures and processes that will foster teacher professionalism and that will be decreasingly reliant on external administration and facilitation.

MATHEMATICS FOCUS

The mathematics focus of the Pittsburgh Mathematics Collaborative is multifaceted, having been greatly influenced by local initiatives. The focus is, in part, directed toward meeting imposed requirements and addressing issues related to the teaching of mathematics; this is evident in the department chairs' discussions and in their work on the third-year mathematics curriculum requirement. Dr. Briars, the school district's Associate Director for Mathematics, provides leadership in this area.

A second aspect of the mathematics focus is directed toward innovation and progress, as evidenced by collaborative-sponsored activities on the use of computers and calculators in the classroom. Supporting teachers' attendance at professional meetings also helps to keep teachers current regarding new trends.

A third aspect of the mathematics focus involves real-word applications of mathematics; this is addressed by the assistant coordinator's efforts to arrange site visits for teachers at local industries and businesses.

In the future, the collaborative will strive to involve local universities and colleges, using their rich mathematical resources to add to the experiences of teachers.

G. Next Steps

Future activities of the Pittsburgh Mathematics Collaborative will be directed toward the long-range goals of the institutionalization of a set of structures and processes. A set of core activities has been planned for the collaborative in cooperation with the Pittsburgh Public Schools. These activities include:

1. redesigning the course content of General Mathematics 1 and 2 and designing a new third-year course for those students meeting minimal mathematics requirements;
2. establishing resource centers in each high school for use, primarily, by teachers and, secondarily, by students;
3. training a selected group of secondary mathematics teachers to become computer literate; and
4. pilot testing three different textbooks for Algebra I. (An evaluation component of this activity has been planned to assess achievement and attitudes of students.)

Three additional collaborative-sponsored inservices will be held in February. Topics include factory automation (Dravo); the actuarial profession (Blue Cross of Western Pennsylvania); and valves and flow controls (Rockwell). In addition, some voluntary programs will be offered, including a trip to the Beaver Valley Power Station, operated by Duquesne Light, on February 27, 1987, and a panel discussion with representatives from proprietary schools on April 1, 1987.

The collaborative will work with the Partnership Program to develop a mathematics focus within partnerships at individual high schools. One proposal would bring a business partner to talk to a teacher's class regarding mathematics applications; the teacher would then visit the work site to observe the business partner on the job. A program in which teachers and business people exchange places for a day is tentatively planned for the 1986-1987 school year.

Tours, demonstrations, and interactive dialogues for all mathematics teachers at business and industry sites will be continued. Approximately six visits each year will be scheduled; at least half will be conducted during teacher inservice time. Finally, the possibility of high school mathematics teachers making presentations to the business community will be explored.

Presentations could include book reviews and talks on topics such as mathematics anxiety and new developments in mathematics education.

Some middle school teachers have expressed interest in collaborative activities. The Steering Committee is supporting pairing high school and middle school teachers for classroom visits. Other possibilities include allowing middle school teachers to attend those inservice programs which feature corporations.

There will be a concerted effort over the next two years to establish ties with institutions of higher education. Current efforts to work with the Department of Mathematics and Statistics and the School of Education of the University of Pittsburgh will be continued. The circle of institutions of higher education working with the collaborative will be widened by including Carnegie-Mellon University, Duquesne University, and other area schools that have teacher-training programs. On November 20, 1980, the collaborative's assistant coordinator met with Professor Cathy Taylor of the Duquesne University Mathematics Department. Professor Taylor also is the regional representative for the Mathematics Association of America. A seminar/working series on research on mathematics learning will be organized, using faculty at Carnegie-Mellon University and the Learning Research and Development Center at the University of Pittsburgh who are leaders in the field.

SUMMARY REPORT:
ST. LOUIS URBAN MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the St. Louis Urban Mathematics Collaborative. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term intent of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during its first year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Mathematics and Science Education Center, a Division of the Network for Educational Development; the meeting in San Francisco of representatives of all of the projects; documents provided by the project staff at the Mathematics and Science Education Center; and three site visits by the staff of the Documentation Project.

ST. LOUIS URBAN MATHEMATICS COLLABORATIVE

A. Purpose

The proposal to the Ford Foundation, written with the active involvement of a group of secondary mathematics teachers, is to establish a mathematics collaborative among St. Louis Public Schools mathematics teachers, university mathematics professors, and mathematicians from local business and industry. Teachers' expectations of the collaborative are that it will:

1. open and expand lines of communications among teachers and within the community;
2. increase teachers' knowledge of mathematics and mathematics applications;
3. garner informed input from local business and industry of the latest technological advances that employ mathematics;
4. demonstrate to students the relevance of mathematics to the work world;
5. improve teachers' instructional techniques;
6. strengthen teachers' bonds with university faculty and other related professionals, and scientific organizations; and
7. deepen teachers' own sense of professionalism about their careers.

The collaborative's primary goals are:

1. Teachers will explore potential resources among businesses, industries, and universities to find out how these resources may assist them in their own professional growth and in their classroom instruction.
2. Teachers will develop, assist in developing, and implement staff training programs for themselves and for their peers.
3. Teachers will assist in improving communications and exchanges of information among all mathematics teachers within each school and across schools.
4. Teachers will promote the recognition of accomplishments and quality performance among all mathematics teachers and students.

B. Context

The population of St. Louis is approximately 431,400; the total metropolitan area has a population over 1 million. The St. Louis Public School District, under the direction of Superintendent of Schools Jerome B. Jones, is composed of 130 schools, including 23 magnet schools. St. Louis County has twenty-three school districts. Since 1980, the St. Louis School District has carried out a court-ordered desegregation busing plan within its borders. In 1982, the plan was expanded to include the voluntary transfer of black students from the city to county school districts, and white students from the county to the city's magnet schools.

During the 1985-1986 school year, the district's enrollment totaled 50,908 students, of which 77.1 percent were black and 22.9 percent were white. There were 12,361 secondary school students. Of this number, 7,126 were district students attending schools in St. Louis County. The majority of the district's students are from low-income families; 40,222 students, including 7,059 high school students, received free school lunches during the 1985-1986 school year.

During 1985-1986 the St. Louis Public Schools had 3,806 certified staff members, of which 66.7 percent were black and 33.3 percent were white. There were 104 mathematics teachers at the secondary level, 57 females (34 black and 23 white), and 47 males (15 black, 28 white, and 4 of other races). Thirty-nine of these teachers held master's degrees, thirty-one held master's degrees with thirty additional hours, and thirty-four teachers held bachelor's degrees. Eighty-six of the teachers were tenured and eighteen had probationary status. In addition to mathematics teachers, there were fourteen computer science teachers, all of whom were formerly mathematics teachers in the St. Louis Public schools.

In September, 1985, 1,647 students in the regular high schools (13 percent of all high school students) were enrolled in mathematics classes, the majority of which were at the ninth-grade level. Pupil-teacher ratio averaged 30:1. Of those enrolled in mathematics classes, 449 were taking non-credit remedial courses, most of which were basic in content. As of June, 1985, the percentages of secondary students scoring above the 50th percentile on the California Achievement Test in mathematics ranged from 26.5 percent (tenth grade) to 34.9 percent (twelfth grade). Within the mathematics test, students consistently performed better on mathematics computation than on concepts and applications.

Another standard used within the district to measure the mathematics achievement of students is the Basic Essential Skills Test (BEST TEST). This is an objective-referenced test mandated by the State of Missouri to assess students' competencies in reading/language arts, mathematics, and government/economics. The test is administered annually to all eighth grade students and to high school students who have not passed a given portion of the test. In 1985, 1,331 students in grades 9 through 12 were required to retake the mathematics portion because they had failed it at the end of their eighth grade; this was the largest number of students ever required to take any portion of the BEST TEST a second time. Approximately 36 percent passed the mathematics portion, while approximately 64 percent were required to retake the mathematics portion the following year. Beginning in 1986, the BEST TEST will be supplemented with another instrument, which, in addition to demanding higher levels of skill, will also include geometry items.

The secondary schools mathematics curriculum currently is under revision; the last major revision occurred in 1976. The curriculum covers topics from remedial mathematics through calculus. In the 1982-1983 school year, a sophomore remedial course entitled "Essential Mathematics Skills," was initiated. In the 1983-1984 school year, two remedial courses, basic education in mathematics (a non-credit course) and general education in mathematics were introduced at the freshman level. If students have not qualified to take algebra or basic algebra (algebra at a slower reading level and with less depth), they are placed in either of the remedial courses. Placement in freshman-level courses is based on students' CAT scores and BEST TEST scores; occasionally, teacher recommendations are considered. More higher level mathematics courses are offered at the Classical Academy and at the Mathematics and Science High School, a magnet school.

There is considered to be a shortage of qualified mathematics teachers in St. Louis, and a number of teachers are holding certification under "sunset" provisions. Teacher morale is declining as the result of many issues, predominant among which is a new stipulation adopted by the School Board that students' achievement test scores be a major element in evaluating teachers. The teachers, therefore, are under considerable pressure to improve students' test scores or face the possibility of termination. Although the need to improve the quality of instruction in the St. Louis Public Schools is recognized, the validity of the testing instruments is questionable. Thus, the effort to use tests as a tool to weed out incompetence is being challenged by the teacher's union. The practice of using test scores to evaluate teachers has also resulted in teachers becoming increasingly reluctant to join any outside project that requires them to be absent from class because of the time this might detract from preparing their students for the test.

There also has been a noted lack of continuity in direction at the supervisory level, indicated by the absence of a Curriculum Division until 1983, the district's failure to appoint its first mathematics supervisor until August, 1984, and such frequent turnover in mathematics supervisors that often only two of the three supervisor positions are filled.

C. Establishment of the Collaborative

The Ford Foundation initially contacted the Danforth Foundation, which funds a number of activities in the St. Louis area, including partial funding of the Mathematics and Science Education Center. The Ford Foundation was referred to the newly created Center as the most appropriate funding agent for a St. Louis collaborative. After meeting in late November, 1985, with Barbara Nelson of the Ford Foundation, the Center decided to apply for a planning grant. A grant of $2,500 was awarded by the Ford Foundation and a committee was established to write the proposal.

A conscious decision was made during its earliest stages that the collaborative would be planned by teachers for teachers. Thus, the planning committee included seven teachers and the principal of the Gifted Program at a regular high school, along with the interim director of the Center (Judy Morton), two staff members from the St. Louis Public Schools (the director of the Partnership Program and a mathematics supervisor from the Curriculum Services Division), and a mathematics coordinator from one of the St. Louis County school districts who served as a consultant. The teachers and principal were recommended by the director of the Partnership Program and the mathematics supervisor.

A survey was administered to all high school mathematics teachers in January, 1986. Teachers were asked to respond to questions in six areas: professional background, curriculum/current status, general concerns, curriculum concerns, recommendations, and interests.

The planning committee met after school and on Saturdays five times between January 4 and February 1, 1986. The needs of secondary mathematics teachers in the district, as well as suggested activities to meet those needs, were listed and discussed with university mathematicians and business and industry representatives. The final proposal was written by the interim director of the Mathematics and Science Education Center, the director of the Partnership Program, the mathematics supervisor, and the mathematics coordinator from one of the St. Louis county school districts.

The collaborative's administrative structure includes a team of four who, along with the Collaborative Council, provide direction for the project. The team consists of Judy Morton, who performs a role similar to that which would be called the director in other collaboratives; Wayne Walker, who is director of the Partnership Program; and Arissa Smith and Winifred Deavens, who are mathematics supervisors in the St. Louis Public Schools' Curriculum Division. Ms. Morton, a former secondary teacher, has consulted in educational technology and computer applications, as well as served as a project administrator. Wayne Walker has a social science background and has been the director of the Partnership Program since its beginning in 1980.

The sixteen-member Collaborative Council is being established, composed of ten educators from the St. Louis Public Schools (possibly including those who planned and wrote the proposal) and two representatives from each of the academic, business and scientific communities. Eight of the council members will change after eight months. A recruitment meeting was held at the Missouri Botanical Gardens November 12 to identify teachers to serve on the Council.

On December 10, 1986, the initial meeting of the Mathematics Collaborative Council was held to plan the activities for the next several months. A second meeting of the Collaborative Council was held December 17, 1986, at the Partnership Program Office. The Council discussed available grants, activities, and financial matters. Initially, the Council plans to meet twice a month, with the next meeting planned for early January.

The mathematics collaborative has the support of seven corporations, three universities and colleges, and four foundations and other cultural associations.

D. Relationship with Other Local Initiatives

During the past five years, the district has intensified its efforts to involve different sectors of the community in improving the academic achievement of students and the professional development of its staff. One district program involved in this effort is the School Partnership Program. Established in 1980, the Partnership program develops instructional programs to reinforce and to enrich the curriculum using the expertise of volunteers from business, industry, universities, cultural agencies, professional organizations, and other groups in the community. These multisession programs encompass and reflect the instructional goals of the teachers and demonstrate to students the application of skills they are learning in school. These programs are conducted in the classroom and at different sites in the community. In 1984-1985, 125 sponsors participated in more than 1,000 Partnership programs involving 35,000 students. This included students from county schools involved in the metropolitan desegregation plan. The Partnership network should provide a firm foundation for the mathematics collaborative.

The Mathematics and Science Education Center was formally initiated on January 29, 1986. Its Board of Directors was constituted in June, 1985, for the purpose of pursuing the development of the Center. An interim director, Judy Morton, was appointed. The Center's first director, Dr. Paul Markowits, assumed his duties on August 18, 1986. Many of the Center's future projects may complement collaborative activities.

The Mathematics and Science Education Center is responsible to its own Board for its activities. There also is a governing board for the Network for Education Development (NED), of which the Center is a division. The chairman of the Center Board sits on the NED Board. There also exists a Policy Board for the Cooperating School Districts, of which NED is a division. Although subordinate boards do not need approval of higher boards for their activities, it is expected that all projects are coordinated with an overarching goal of assisting schools and districts in educating their students in the best manner possible.

E. Project Activities

The collaborative's first activity was to fund several teachers to attend "Interface 86," a state conference in Jefferson City April 28 through April 30, 1986. The conference was designed to increase awareness and understanding of the linkages between science and mathematics theory and technology. The sessions also enabled teachers to make contacts with people in business and industry.

In May, 1986, the collaborative sponsored a meeting to further develop two activities planned for the summer: preparation of a list of resources, and one-day visits to local businesses. Teachers who had served on the planning committee for the collaborative proposal and the department heads of each high school were invited to attend.

That summer, five groups of three teachers each spent about thirty hours compiling resource lists. Each group was responsible for identifying resources in one of five categories: people/organizations, information exchange among schools via data communications, books and journals, videotapes and films, and computer software. A booklet of the completed lists will be distributed to all mathematics teachers.

During the summer, the collaborative organized site visits for teachers at area businesses. Five teachers participated in each visit. In the morning, the teachers received information about the business, about how it used mathematics and the mathematics prerequisites it required in hiring. Participating businesses were asked to provide lunch for the teachers, and to have business associates attend the lunch. In the afternoon, the teachers accompanied the business representatives to observe their work activities.

On October 30, 1986, a planning meeting for all St. Louis Public Schools secondary mathematics teachers was held at the University of St. Louis-Missouri. The meeting was designed to provide teachers an opportunity to plan some professional activities in which they would like to participate during the 1986-1987 school year and the following summer. Several opportunities were discussed, including visits to businesses, internships, advanced study, project and program development, a series of speakers, and a newsletter.

A second meeting was held November 20, 1986, at the Missouri Botanical Gardens. At this meeting, other potential collaborative activities were discussed, including grant-writing assistance, workshops at the Missouri State Teachers Association Teaching Academy, participation in the EQUALS Program, and participation in projects from the National Diffusion Network.

On December 10, 1986, the collaborative sponsored a grant-writing seminar for secondary school mathematics teachers at La Veranda Restaurant in St. Louis. Information was made available about two grant programs available to teachers in the St. Louis Public Schools: The Incentives for School Excellence Program, sponsored by the State Department of Education; and Southwestern Bell Mini-Grants, sponsored in conjunction with the St. Louis School Partnership Program. Tom Prater, Director of the Missouri Facilitator Center, discussed the National Diffusion Project facility, which serves Missouri teachers who want access to various national educational programs. Mr. Prater brought with him an extensive display of mathematics materials, books, curriculum guides, and sample proposals which the teachers examined while he spoke. He also offered to send materials to teachers interested in using the Facilitator Center, and to return to the collaborative on a future date to spend additional time helping mathematics teachers become aware of opportunities to bring enrichment programs to St. Louis.

F. Observations

It is too early in the collaborative's development to formally evaluate its progress. However, five features of this project are of note.

First, the program is founded on the premise that the opportunity exists to broaden teachers' perceptions of available resources. In brief, the collaborative's intent has been to shift the notion of resources provision from satisfaction of a "wish list" to one of supporting and constructing new professional opportunities. With this in mind, the proposal-writing exercise was used to emphasize the focal role of teachers in the long-term planning of the project. This type of early teacher involvement is quite different from the approaches taken by other collaborative projects and merits careful documentation.

Second, the central role of teachers is further emphasized by the decision to establish a teacher-based Collaborative Council, which will determine all further activities. Initial problems in recruiting teachers for this Council draw attention to the validity of the assumption that teachers can or wish to undertake the work involved in fulfilling this role and the need to identify strategies for the involvement of teachers in such activities.

An important element in the early establishment of school district and teacher involvement is the collaborative director's prior contact with teachers and principals as a computer consultant. The success of Ms. Morton's efforts was evidenced by teachers' positive attitude toward her during the proposal-writing phase.

Third, the project is related in a specific way to the organizational structures of the St. Louis Public Schools, and must operate within this framework. The long-term home of collaborative activities is expected to be the school system. This expectation is fundamental in setting priorities and in assisting the district's curriculum and staff-development divisions to better support teachers in the schools.

Fourth, as with each new collaborative, project management needs to be further defined. This will be a challenge for the St. Louis Collaborative in light of its emphasis on teacher involvement, the collaboration with the St. Louis Public Schools, and the fact that the development of the collaborative is the initial project of the Mathematics and Science Education Center.

Finally, it will be important to document the relationship of the collaborative's activities to the school administration's mounting pressure on teachers to improve test scores. Whether collaborative activities complement or contradict (or are perceived by teachers to complement or contradict) the demands of the administration must be considered.

G. Next Steps

The next major step for the St. Louis Collaborative is the further development of the teacher-run Collaborative Council. Three teams of seven members each will be formed to assist the Council. One team will concentrate on teaching mathematics, a second will concentrate on teachers' networks, and a third will concentrate on mathematics development. Team membership will include at least one representative from each of the high schools, one representative from universities and colleges, one representative from business and industry, and one representative of the Council to serve as a liaison.

Upcoming activities of the Council include a seminar on grant writing for the mathematics or science classrooms, scheduled January 21, 1987, and a visit from the EQUALS team in late March. One-day visits to businesses also are being planned for spring semester.

SUMMARY REPORT:
SAN DIEGO URBAN MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the San Diego Urban Mathematics Collaborative. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal for funding submitted by the San Diego Urban Mathematics Collaborative to the Ford Foundation; monthly reports from the on-site observer; the meeting in San Francisco of representatives of all of the projects; and one site visit by the staff of the Documentation Project.

SAN DIEGO URBAN MATHEMATICS COLLABORATIVE

A. Purpose

The primary goal of the San Diego Urban Mathematics Collaborative is to improve the professional lives of teachers in the San Diego area by reducing their tendency to work in isolation and by increasing the contacts that foster mutual support, professional growth, and involvement with the larger professional mathematics community.

B. Context

The San Diego metropolitan area has a population of 1,862,000, of which 876,000 reside in the city. San Diego is an industrialized area which is growing rapidly; its population is expected to increase by an average of 2.3 percent annually over the next decade. Eighty percent of this growth will result from employment-related immigration. Ethnic minorities currently comprise 26 percent of San Diego county's population, and a larger proportion of the city's, including a significant undocumented Mexican population. San Diego's major economic sectors have involved tourism, manufacturing, and the military. However, the San Diego business climate is attracting many new high technology companies to the area, and defense contracting has become an important economic factor. The growth rate for new jobs, especially skilled jobs, is expected to outpace general population growth. A major challenge facing the region is the development of a labor force that can satisfy industry's needs and retain high technology business. This challenge has prompted an increasing interest in helping San Diego's schools to provide a contemporary education for a growing Hispanic and black population.

The San Diego Urban Mathematics Collaborative serves mathematics teachers in the San Diego Unified School District and the Sweetwater Union High School District. During its first year, however, the collaborative will focus its efforts on reaching and serving the teachers from one high school and two feeder junior high or middle schools in each of the two districts.

Dr. Thomas Payzant is the superintendent of San Diego Unified School District. As of October, 1986, district enrollment totalled 115,461. Of this total, 46 percent were white, 20 percent were Hispanic, 16 percent were black, 7 percent were Filipino, 7 percent were Indo-Chinese, and 4 percent were members of other minorities. A total of 5,290 classroom teachers taught in the district's 107 elementary schools, 8 middle schools, 11 junior high schools, and 15 high schools.

The San Diego School District's salary ladder allows teachers to earn credits for increments through inservice and university coursework, as well as experience. The district's maximum salary is payable to a teacher who has fifteen years of experience, plus ninety credit points, and a master's degree.

In the San Diego city schools, instructional decisions are made by Vance Mills, a mathematics/science specialist, who is also a member of the collaborative's Executive Committee. Mills has the authority to select textbooks with the help of a teacher committee. Other district decisions, such as teacher transfers, are handled by the district's Education Center, which bases its decisions on teacher seniority and the requirements of individual schools.

Sixty-six mathematics teachers from six schools were selected to become involved in the collaborative during its first year. The three schools from the San Diego Unified School District that were selected to participate are Samuel F. B. Morse High School, and its two feeder schools, Alexander Graham Bell Junior High School and Kieller Middle School. The three schools from the Sweetwater Unified High School District chosen to participate in the collaborative are Sweetwater High School and its two feeder schools, National City Junior High School and Granger Junior High School. It should be noted that after these schools had been identified, four of the six had a change in principal.

Samuel F. B. Morse High School serves a large portion of southeast San Diego, but the school's Math/Science Center for Engineering and Aerospace Magnet Program also draws students from different parts of the city. The majority of the school's 2,118 students are members of minority groups. Educational Partnership Programs with Naval Air Rework Facility, General Dynamics/Convair, and San Diego City Schools Data Systems offer students hands-on avionic work and clerical experiences. There are eighteen mathematics teachers at Morse High School.

The enrollment at Alexander Graham Bell Junior High School totals 2,253, of which 74 percent are minorities. Although most students live in the geographical area of the school, the Math/Science/Computer Magnet program draws students from other areas of the city. In 1984-1985, Bell's language arts CTBS scores for grades seven though nine were the highest in the district, and its two mathematics CTBS scores ranked third and fourth out of twenty-two schools. There are sixteen mathematics teachers at Bell Junior High School.

Kieller Middle School is a Fundamental Magnet, drawing students from many parts of the San Diego metropolitan area. Kieller's curriculum emphasizes basic skills improvement. Of the school's 653 students, 70 percent are minorities. There are eight mathematics teachers at Kieller Middle School.

The Sweetwater Union High School District is located between the city of San Diego and the Mexican border. The district includes National City and parts of two other communities. As of October, 1986, the district's 25,045 students were distributed among seven junior high schools, two middle schools, eight high schools, and three schools targeted for specific populations, including a vocational education school, a continuing education school, and a school for the handicapped. Of the students enrolled in Sweetwater schools, 50 percent are Hispanic, 31 percent are white, 11 percent are Filipino, 4 percent are black, and 4 percent are other minorities. Currently, the drop out rate is a problem, and the district's test scores are among the lowest in the state. The district employs 1,049 classroom teachers.

Anthony J. Trujillo, the superintendent of the Sweetwater Union High School District, came to the district three years ago from Marin County. One of his major goals has been the improvement of teaching, and, as a means towards this end, he regularly visits classrooms. The mathematics collaborative's efforts are consistent with Mr. Trujillo's priorities for the district.

Sweetwater High School is located in a low-income suburb of San Diego. It serves a mixed residential, commercial, and industrial community. Over 27 percent of its families receive Aid to Families with Dependent Children (AFDC). Eighty-two percent of the 1,801 students and 40 percent of the staff are of mixed ethnic minority background. Only 10 percent of students go on to college. Eighty percent of the student body score below the 36th percentile on the Comprehensive Test of Basic Skills (CTBS). The majority of the eleven mathematics teachers at Sweetwater High School have been educators for more than twelve years. Their major concerns involve a lack of time to meet with peers and a need for assistance with mathematics content.

National City Junior High School serves several predominantly low-income neighborhoods. Twenty-seven percent of its families receive AFDC; 85 percent of its students receive free or reduced-price lunches. Of its 1,029 students, 87 percent are classified as minority students. Student performance on the CTBS was below grade level in language and mathematics. Several of the school's seven mathematics teachers are "cross-over" teachers who are teaching under a General Teaching Credential. One concern expressed by the staff is that about 60 percent of students are unable to obtain any type of computer-use exposure outside of the school setting.

Granger Junior High School has a student population of 915, of which more than 50 percent are minorities. Approximately 59 percent of the students receive free or reduced-price lunches. On the basis of their low CTBS scores, more than 33 percent of the students are identified for Chapter I of the Elementary and Secondary Education Act supplemental programs. The majority of the seven mathematics teachers have strong mathematics backgrounds but feel they need support in developing programs which address the problems particular to their community and their students.

The San Diego area traditionally has been rich in mathematics education resources. The Center for Research in Mathematics and Science Education at San Diego State University, under the direction of Professor Edward A. Silver, studies important applied problems in the field of mathematics and science education. The center's primary goal is the production or application of knowledge that is theoretically important or practically useful; it seeks to involve its members in exploring policy issues with local, state, and national groups concerned with mathematics and science education.

The Greater San Diego Mathematics Council (GSBMC) is an 800-member affiliate of the National Council of Teachers of Mathematics and of the California Mathematics Council. This group is also a member of the Greater San Diego Industry-Education Council and the Greater San Diego High Tech Industry-Education Consortium. The GSDMC encourages professional growth for mathematics teachers in San Diego County by providing publications, workshops, seminars, and an annual conference.

The Greater San Diego Industry-Education Council (GSDIEC) includes educators, business/industry leaders, and military representatives. This council provides recognition for educators and other personnel from business and the military who devote time beyond normal job activities to exemplary educational projects.

The Partnerships in Education (PIE) group was formed by business, industry, and military representatives, and the County Office of Education to promote academic excellence. Its activities addressed the critical shortage of mathematics and sciences teachers by forming the Greater San Diego High Tech Industry-Education Consortium (GSDHTIEC). The first project of PIE for the 1986-1987 school year will be an Industry Fellow Program, involving industrial summer internships for teachers.

In addition, the Greater San Diego Chamber of Commerce Education Committee has been an active collaborative partner in reacting to the needs of the school system.

Two teacher education projects at the San Diego State University provide opportunities for teachers. The San Diego Mathematics Project is a leadership program for teachers of mathematics in grades K-12. Project participants attended an inservice this summer and a retreat in the fall of 1986, as well as meetings held periodically throughout the 1986-1987 school year. Professor Nicholas A. Branca directs the project, which is sponsored by the university, the San Diego County Office of Education, and the Region 15 Teacher Education and Computer Center.

The San Diego Mathematics Teacher Enhancement Project has been available to mathematics teachers in grades five through twelve during the summer and fall of 1986, and will continue throughout the spring of 1987. The "Implementing the Framework" workshop component is designed for fully certified mathematics teachers who wish to upgrade their mathematical and pedagogical knowledge and wish to play a leadership role in implementing the California Mathematics Framework in their schools and districts. The "Going Beyond the Minimum" component is designed for "cross-over" or underprepared teachers of secondary, junior high, or middle school mathematics who wish to develop their mathematics background beyond the minimum required by the Commission on Teacher Credentialing. Professor Silver directs the project, which is sponsored by the university, county, and Region 15 TEC Center.

C. Establishment of the Collaborative

The original discussion regarding the establishment of a mathematics collaborative in San Diego occurred in the fall of 1985; Barbara Nelson of the Ford Foundation contacted Professor Douglas McLeod, of the Department of Mathematics at San Diego State University. An initial series of talks among four members of the department centered around the need for such an initiative in the city. Those involved were Professors McLeod, Alma Marosz, Edward Silver and Nicholas Branca. At Professor Marosz's suggestion, Frank Holmes was invited to join the group. Mr. Holmes has extensive contacts with minority groups through his work as Director of the SDSU College of Engineering's Minority Engineering Program.

Professor McLeod notified Barbara Nelson that the group believed that a project was feasible. Consequently, she visited San Diego in November, 1985, for further discussion with an expanded group that included SDSU mathematics education and mathematics faculty; representatives of the city, county, and Sweetwater school districts. Also present were members of the Urban League and the Mexican-American Assistance League. Eight teachers, chosen because of their previous contacts with the mathematics and mathematics education faculty of SDSU, were included. After the meeting, the Ford Foundation agreed to fund the preparation of a grant application.

The proposal was prepared by a group of fifteen, consisting of SDSU faculty, mathematics specialists from the city and county school districts, the computer specialist of the Sweetwater district and the eight secondary school teachers, with four or five of the teachers attending any single meeting. The group met six times, with an average attendance of about twelve. The proposal was written by an Executive Committee composed of Professors Marosz, Silver and McLeod; a local teacher, Ms. Elizabeth Schlesinger; and two of the district specialists.

On February 4, 1986, Barbara Nelson visited a second time and met with professors Marosz, McLeod, and Silver; Frank Holmes; Mike Mellon of the Region 15 TEC Center; and John Lenahan, chairman of the newly formed business-education consortium. Mr. Lenahan was very supportive of the collaborative idea and stressed the importance of schools providing a good technical labor force in San Diego. The issue of collaborative leadership was discussed but no decision was made because of the potential of Doug McLeod leaving the area and Alma Marosz retiring from SDSU. The collaborative proposal, submitted February 24, 1986, asked for funding from April 15, 1986, to August 31, 1987. The Ford Foundation awarded the grant in April, 1986.

Currently, Alma Marosz, who is the project director, is contributing her effort as an unpaid volunteer. Beth Schlesinger and Frank Holmes coordinate collaborative activities. Ms. Schlesinger, a mathematics teacher in San Diego since 1968, divides her time between the district (40 percent) and the collaborative (60 percent, paid out to the district). She works directly with the targeted teachers, coordinating project activities with the mathematics education faculty. Mr. Holmes, who holds a master's degree in counseling and a doctorate of law, is employed at the School of Engineering at SDSU and also practices law. He is paid by the collaborative for 25 percent overload time. Mr. Holmes is responsible for administrative details, especially as they relate to the SDSU Foundation. He also is a liaison between the project staff and the minority community. The on-site observer is Dr. Sharon Whitehurst, the Affirmative Action Program Administrator for the San Diego City Schools. A part-time secretary soon will be hired.

Neither of the larger groups have met since the proposal writing phase of the collaborative's development. With Professor McLeod's departure in mid-1986 on a two-year leave, the Executive Committee's membership was altered to include Alma Marosz, Frank Holmes, Ed Silver, mathematics specialists from the city and county, Beth Schlesinger, and five teachers. After receiving input from other collaboratives at the San Francisco meeting in October, 1986, the membership has been expanded to include one representative from each of the six schools participating in the collaborative; these representatives were selected by teachers in the six schools. Were possible, the committee will meet in the various school buildings.

The reformulated committee met for the first time December 11, 1986. In attendance were the collaborative director and coordinators; three teachers, each representing a different junior high school; and three members of the mathematics education faculty. Discussion focused on the fall activities of the collaborative; a collaborative retreat scheduled March 6 and 7 at Lake Arrowhead; an inservice for collaborative teachers to be conducted by Bell Junior High School teachers on January 29, 1987; and an invitation to Uri Treisman, University of California-Berkeley, to speak to collaborative members in February.

The Executive Committee decided very early on that an appropriate strategy for establishing a collaborative would be to concentrate on a limited number of schools and utilize the feeder system of junior and senior high schools in the city and Sweetwater school districts. A senior high school and its two feeder junior highs were to be targeted in each district. Once the committee selected a city junior high school commonly viewed as a role model of what could be achieved by an organized staff team, the two city schools linked with it in the feeder system were automatically involved. The Sweetwater schools were chosen by the computer specialist in the district; her subsequent resignation has made it impossible to ascertain her criteria.

The levels of support from the two districts are worthy of note. The superintendent of the Sweetwater district attended the original planning meeting. After challenging the appropriateness of teachers spending time away from their classrooms any more than was necessary, he offered financial support for activities in his district if it were clear that teachers were committing time outside school hours. He has succeeded in having his Board approve $15,000 for this purpose. Traditionally, teachers from Sweetwater schools have been unable to attend professional meetings; with the allocated funds, the superintendent obtained a commitment from the Board to allow teachers to take advantage of such meetings. The San Diego Unified School District did not provide funds directly but has provided release time for teachers.

In the spring of 1986, the collaborative distributed a questionnaire to teachers in the six target schools, soliciting suggestions for activities. On the basis of the returns, the Executive Committee established a program for the 1986-1987 school year. Upon reflection, however, the committee has concluded that this was not the ideal approach, as it further removed the actual decision making from the teachers and reinforced the prevailing perception that they were being "dictated to."

Initial contacts in both districts involved the principals. In Sweetwater, collaborative representatives met with the principal and the teachers in each school. In the city, district personnel attended the first meeting with the principal; follow-up involved the principal alone. The first direct contact with teachers occurred at a pre-summer cheese gathering at San Diego State University in June.

D. Relationship with Other Local Initiatives

The Greater San Diego Mathematics Council supports mathematics education in San Diego County by sponsoring contests and field days, including the Elementary Mathematics Field Day, the Junior High Mathematics Field Day, the Senior High Mathematics Field Day, the Mathematics Counts Contest for seventh and eighth graders, and the Honors Mathematics Contest for senior high students. In February, 1987, most mathematics teachers from Bell Junior High School will attend a two-day meeting of the Mathematics Council. A day-long program will be organized at the school to engage students in useful activity while reducing the reliance on large numbers of substitute teachers.

Industry has become involved with the schools through the local Technical Center. An Education and High Technology Consortium, involving representatives from the county, schools, and industry has been operating for a year. The Consortium is an outgrowth of the California Roundtable and is dedicated to improving the quality of high school graduates in the area. The Roundtable's only accomplishment has been development of a set of guidelines for business. Currently, the consortium appears to be discussing, rather than implementing, its goals. Its initial project of summer internships faltered after fewer possibilities had been anticipated were identified. Its first report is yet to appear.

The Executive Committee has asked to attend a Consortium meeting to discuss possible links with the collaborative, but it has received no response. A second possible link into industrial initiatives is available through Frank Holmes's contacts with the Mathematics, Engineering, and Science Achievement (MESA) program, and the university's minority engineering program. As yet, the collaborative has no industry funding.

Through the Technical Assistance Project at the Education Development Center, the collaborative learned of the interest of SIAM, the Society of Industrial and Applied Mathematicians, in working with teachers. Two SIAM speakers have been suggested for the San Diego area.

E. Project Activities

A rich array of resources in San Diego provides a wide variety of opportunities for improving the professional lives of mathematics teachers in the San Diego area. These resources include: the Center for Research in Mathematics and Science Education (CRMSE), the Greater San Diego Mathematics Council (GSDMC), the Greater San Diego Industry Education Council (GSDIEC), Partnerships in Education (PIE), the Greater San Diego Chamber of Commerce Education Committee, the San Diego Mathematics Project, and the San Diego Mathematics Teachers Enhancement Project.

The collaborative's major focus is to promote networking among these resources (rather than creating new resources) and to encourage teachers to take advantage of the opportunities already available to them. However, because resources do not always reach the mathematics teachers who need them most, the collaborative also sponsors selected activities.

COLLABORATIVE SPONSORED ACTIVITIES

Although the San Diego Urban Mathematics Collaborative did not receive its funding until April 15, 1986, the collaborative sponsored several activities for teachers in the target schools during 1986.

Wine and Cheese Reception

In June, 1986, the collaborative held a reception for the sixty-six mathematics teachers from the six target to enable the teachers to begin to know one another before summer began.

Evening Dinner Colloquium and Social

On Monday, September 22, the collaborative sponsored an evening dinner and colloquium at the Aztec Center of San Diego State University. All the mathematics teachers from the six participating schools were invited. There was no charge for the evening, but participants were requested to make advance reservations. Twenty-seven people attended, including project staff and board members; this was fewer than had been anticipated.

This initial activity was designed to introduce all collaborative participants to one another. The evening was intended to be both intellectually stimulating and fun. Dr. Vince Harris of the Department of Mathematical Sciences at San Diego State University spoke on "Rabbits, Rectangles, and Regular Decagons."

While they viewed the evening as a successful social event, many participants felt the program was irrelevant. One teacher said, "It was really fun. It was a good chance to meet other people involved in this type of thing. The program was not applicable but [as a former math major] it was good for me to see that kind of thing again. I really did think that the whole idea was to get us back into being mathematicians rather than into just being teachers. The excitement of mathematics needs to be brought back into teaching." Comments from two other teachers were: "Teachers would have preferred something more applicable to the program that they are working with"; and "I thought that the materials that he talked about were way over anything for my kids. . . . it was over my head."

Many of the teachers did express an interest in the collaborative and an eagerness to see it established. They seemed particularly interested in the collaborative's commitment to helping teachers to attend professional conferences. One teacher said, "I'm waiting for something to happen. Other teachers are waiting for this thing to fit together. Teachers are waiting for directors and coordinators to decide what they want to do. Some of the things that they will do, we've not been able to do yet. Things like financing state and national conferences. It's a Catch 22. Some of our ideas are not possible. Their ideas--no one's interested. They need to figure out what they want to do." Another said, "I'm really looking forward to the chance to go back to conferences. After Proposition 13, that was not an option anymore at my school. The announcements were informational only."

Mini-course in Discrete Mathematics

A eleven session mini-course in discrete mathematics was sponsored by the collaborative in fall, 1986. The first session, held at one of the six collaborative schools, was scheduled Tuesday, October 7. The group decided to meet from 3:30 to 5:15 on ten successive Tuesday afternoons. Project Director Marosz of the Department of Mathematical Sciences of San Diego State University was the instructor; topics to be covered included logic, sets, and set theory. An invitation to join the course was sent to the six participating schools; the letter was mistakenly sent to all schools in the Sweetwater Union High School District as well. Eight teachers enrolled in the course, five from the collaborative schools and three from other Sweetwater schools. If there is interest, a second set of eleven sessions will be offered during the second semester. Teachers who complete the course will earn district hurdle credit for advancement on the career ladder.

Workshop--Technology in the Classroom

On Saturday, October 11, the collaborative sponsored a day-long series of workshops entitled "Technology in the Classroom." The workshops, held at San Diego State University, were taught by faculty from SDSU and from the University of California-San Diego, staff from the TEC Center, and teachers. The workshops featured demonstrations of Mu Math, Symbolic Manipulator, and Electronic Blackboard, as well as hands-on experience with Logo and Geometric Supposer, and calculator activities. A complimentary lunch was provided, and participants received a $50 stipend for full-day attendance.

Mathematics teachers from all of the target schools were invited; 17 teachers attended. Three of the target schools were not represented, while three teachers who were not from the target schools did attend. The lower-than-anticipated attendance was attributed to lack of publicity in the target schools.

Workshop participants reported that the activity was very worthwhile; the sessions were good and the speakers were interesting. The teachers seemed to appreciate in particular the opportunity to see the demonstrations of the Geometric Supposer and the Symbolic Manipulator. One teacher commented, "[The workshop] helped to dissipate any fears of technology as teaching tools." Teachers also commented on the value of interating with other mathematics teachers. One teacher said that one of the best things about the workshop was "the support of the people attending and conducting the workshop with regard to implementing the ideas discussed." Another teacher requested that participants be allowed to bring guests (who would not receive the stipend) from non-target schools.

Greater San Diego Mathematics Council

The collaborative paid for all of the mathematics teachers from the six target schools to be enrolled in the Greater San Diego Mathematics Council and has encouraged their active participation.

RELATED ACTIVITIES

Several programs and activities sponsored by other agencies and organizations were available to mathematics teachers in the collaborative. Some of these are highlighted below.

Summer Workshops

Teachers from five of the six targeted schools attended one of two workshops at SDSU during the summer. The collaborative had reserved spaces for teachers from the six schools. Ten teachers, two from each school except Kieller, participated in the San Diego Mathematics Project. Another six teachers participated in the San Diego Mathematics Teacher Enhancement Project.

California Math Council (Southern Section Conference)

On November 21 and 22, the Southern Section of the California Math Council held a two-day conference in Long Beach, California. As part of its effort to encourage teachers to establish contact with the broader professional mathematics community, the collaborative offered stipends to forty teachers to cover the registration fee, travel, and accommodations for the conference. Twenty teachers took advantage of the opportunity to attend the conference.

Prior to the conference, the collaborative sent information about sessions and workshops to the teachers who were to attend in order to assist them in utilizing the conference to the best advantage. Friday evening, November 21, Beth Schlesinger and Alma Marosz hosted a wine-and-cheese gathering for conference participants from San Diego. Some teachers commented it was their first opportunity to get together in a long time.

The five teachers interviewed after the conference felt the event was very worthwhile. Some teachers reported they had made changes in their classrooms as a result of their conference participation. One teacher said, "Sessions on minority students in calculus grouping is important. I have done more grouping since then." Another commented, "I went to several sessions on cooperative learning. I am going to use some in my classes." Other comments stressed the value of interacting with other teachers. For example, one teacher said, "[A strength was] going together, sharing in the car, restaurant, etc. Not just the conference. We learned a lot about each other." Another said, "There were teachers right at the junior highs that I didn't know."

Research Grants at the Center for Research in Mathematics Science and Education (CRMSE)

Several mathematics education research grants administered by the Center for Research in Mathematics and Science Education impact directly on collaborative teachers. One such grant from NSF focuses on the affective factors that impact on mathematical performance in problem solving and will involve an interdisciplinary team, including cognitive scientists and mathematicians, mathematics education researchers, and teachers. Another research grant, designed to improve junior high students' quantitative thinking skills, is based at Keiller Middle School. Grant activities included peer tutoring by students from other schools in the San Diego Unified School District (the grant's funding agency), team teaching involving school staff and SDSU faculty, and development of supplemental quantitative activities in the eighth grade science course. More than forty activities were developed and will be evaluated during 1987. A third grant, funded by the San Diego County Teacher Education and Computer Center, also was centered at Keiller Middle School. A MacIntosh personal computer was donated and placed in a mathematics classroom. Together, the middle school teacher and the director of the grant project developed innovative ways in which the MacIntosh could be used to supplement normal classroom instruction.

F. Observations

The San Diego Urban Mathematics Collaborative has made great strides in its first year. Discussion of the collaborative's growth will focus on four major issues: Project Management, Collaboration, Teacher Professionalism and Mathematics Focus.

PROJECT MANAGEMENT

There has been some difficulty in gaining teacher acceptance of the collaborative, particularly in those schools in which the staff had little or no input into the initial decision to participate. In retrospect, the Executive Committee has recognized the importance of involving teachers in all stages of the planning process.

To counteract the initial reluctance of Sweetwater teachers about participating in the collaborative, the project's coordinators made a concerted effort to establish direct, personal contact with them. The coordinators have discovered that relaying information directly to the teachers results in greater enthusiasm than when information was mediated through the principals and department chairs.

The major thrust of the Executive Committee's efforts currently is directed toward spending time in the schools and instilling in teachers a sense of project ownership. These priorities emerged in response to some reluctance on the part of a number of teachers to become involved. The reorganization of the Teachers' Advisory Committee in late fall, 1986, should contribute to a general sense of ownership and involvement.

In an administrative sense, the collaborative is learning to work with its participating school districts, despite differences in the way the two districts function. For example, release time for Sweetwater teachers to attend the California Mathematics Council Conference was granted by the principals; in the San Diego Unified School district, the mathematics supervisor arranged for substitutes. In Sweetwater, the collaborative has established direct contact with the superintendent. In San Diego, which is one of the largest school districts in the country, the project's contact person is Dr. Bertha O. Pendleton, a special assistant to the Superintendent Payzant. However, the collaborative does have some direct contact with the superintendent: Dr. Whitehurst, the collaborative's on-site observer, chairs an advisory committee that meets regularly with Dr. Payzant; Frank Holmes, one of the two coordinators for the collaborative project, serves on another advisory committee that also meets with the superintendent. Beth Schlesinger, also a coordinator, has worked in the district for eighteen years and has established networks with the mathematics teachers and supervisors.

COLLABORATION

The administration of the collaborative is well grounded in the San Diego State University and the two school districts. Substantial effort will be required to initiate and maintain the involvement of representatives of business and industry. The San

Diego Urban Mathematics Collaborative has been able to get assistance from the other collaboratives in this regard.

TEACHER PROFESSIONALISM

It is interesting to note that teachers' initial reaction to the question of how the collaborative could be of value was to present a list of physical materials which would be directly applicable to classroom instruction. The second response related to a feeling of powerlessness: a litany of grievances and the perception that school administrators do not listen to teachers. At a meeting between a member of the Executive Committee and a target school's mathematics staff, which included the assistant principal who was a former mathematics teacher, teachers complained of a lack of administrative responsiveness. The assistant principal remarked that administrators do not have time to consider every individual request for equipment, and that if teachers were to plan, prioritize, and submit a package of requests, they would be much more successful. This type of encouragement from school administrators could have a positive impact on the collaborative, providing additional incentive for teachers to collaborate and to work together.

The degree of cohesion within each mathematics department in the target schools appears to vary greatly. At Bell Junior High, for example, the department has developed a high level of staff collegiality and a sense of mission. This is reflected in the department's success in obtaining resources, as well as the staff's readiness to seek new avenues for and types of resources. The school has already obtained $30,000 worth of hardware, computers, and a bulletin board system as a result of a grant application to the Classroom Teacher Instructional Improvement Program (CTIIP). The department has asked the collaborative's Executive Committee to identify individuals or organizations it deems appropriate for involvement in the school's annual career day. In direct contrast, another target school depends upon Frank Holmes' visits as its means of organizing regular meetings of its mathematics department to develop collaborative activities in the school. It should be noted that this school was not involved in its selection as a collaborative target school.

The level of teachers' interest in the collaborative also varies; one apparent factor involves a teacher's proximity to retirement. It is hoped that a dynamic will emerge within the target schools so that the involvement of new teachers will be automatically assumed rather than a matter of debate.

MATHEMATICS FOCUS

The San Diego collaborative is based on a strong tradition in mathematics education. San Diego State University has a very active mathematical sciences faculty who have developed and implemented a number of projects for area teachers. These activities, many of which were sponsored by the Center for Research in Mathematics and Science Education, have focused on the teaching of mathematics.

The Greater San Diego Mathematics Council has a national reputation for its high level of activity. In paying Council dues for the teachers in the six targeted school, the collaborative is providing a link to a larger community with a primary focus on mathematics education.

G. Next Steps

Several concrete steps have been planned for the coming year. They include:

1. encouraging the development of curricular units in the schools in relationship to the California Framework for Mathematics;
2. a workshop, to be conducted by the mathematics department of Alexander Graham Bell Junior High School, on January 29, 1987. Teachers from the other collaborative schools will be invited to discuss the value and impact of department cohesion. The collaborative has acknowledged the value of two or three teachers from one school attending activities together, thereby fostering peer support when teachers try to implement the new ideas in their own classrooms;
3. stimulating contact between the senior high schools and their feeder junior highs. It is assumed that teacher involvement in the collaborative from all participant schools will provide a mechanism for this;
4. involving minority groups, such as the Urban League. This will be done gradually, however, as it is felt that it is better to involve teachers in the planning process before incorporating other interest groups;
5. a presentation in February by Uri Treisman, University of California-Berkeley, on equity and mathematics; and
6. a Collaborative Retreat March 6 through 8, 1987, at Lake Arrowhead.

SUMMARY REPORT:
SAN FRANCISCO MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the San Francisco Mathematics Collaborative. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the San Francisco Mathematics Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco of representatives of all of the projects; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

SAN FRANCISCO MATHEMATICS COLLABORATIVE

A. Purpose

The purpose of the San Francisco Mathematics Collaborative, as stated in the original funding proposal, is to show teachers "how mathematics is imbedded in the world around us, while being sensitive to the needs and interests of the teachers involved in the program." This statement of purpose continues to provide direction for the collaborative.

Three main goals of the collaborative have been identified. The first involves teachers' professional development as mathematicians and educational leaders. The collaborative will work to develop leadership skills in teachers and department heads, provide seminars to inform teachers of new developments in discrete mathematics and research in mathematics learning, and provide opportunities for teachers to serve as mentors and to attend conferences. The collaborative's second goal is to build collegiality among teachers, and networks between teachers, and other mathematics professionals. Mathematics professionals will be invited to collaborative activities, and the collaborative will continue to work closely with the Exploratorium and with other institutions. The project's third goal is to enable teachers to infuse into their instruction a sense of the imbeddedness of mathematics in the real world. The collaborative will work to develop teacher awareness of the changing world of mathematics by presenting bi-monthly seminars on topics related to discrete mathematics, providing Summer Institutes, and awarding teachers grants for classroom projects.

B. Context

The city of San Francisco, which comprises all of San Francisco County, has a population of approximately 700,000. The area is served by the San Francisco Unified School District, which has 107 schools with approximately 60,000 students enrolled in grades K through 12. More than 80 percent of district students are minorities and English is the second language for almost half of the student population.

San Francisco has twenty-three high schools; fourteen are small, alternative schools, while nine are major high schools with enrollments ranging between 1,500 and 2,000 students. The district has 207 mathematics teachers at the high school level; of these, 105 have a college minor or major, or an advanced degree, in the subject. It is this group of 105 mathematics-related teachers that comprises the collaborative's target audience. Thirty-eight percent of these individuals are minorities; 45 percent are over 50 years old. While about 80 percent of the students take two or more years of mathematics, recent legislation mandates that all students take two years of mathematics for graduation.

A new superintendent of schools, Ramon Cortines, was appointed April 30, 1986, and took office that summer. Mr. Cortines, who was given a three-year contract, previously was superintendent of schools in San Jose and Pasadena. He appointed Linda Davis, former assistant superintendent of Pasadena, as deputy superintendent, and Carlos Cornejo, former acting superintendent in San Francisco, to direct the district's desegregation efforts. Superintendent Cortines has challenged school principals to improve students' scores on the California Assessment Program tests. His goals for the 1986-1987 school year are to improve learning and student achievement, and to improve parent involvement and community participation in the schools.

In September, 1986, teachers returned to school without a labor contract. A $321.6 million budget approved by the school board did not include pay raises for teachers. The budget did include categorical funds of $32.2 million over the 1985-1986 budget, allocated for the school integration fund. On October 31, 1986, teachers threatened a one-day walkout after district negotiators offered them a 1.5% raise, retroactive to July 1; the walkout never occurred. A second one-day walkout, scheduled for November 26, was cancelled after contract negotiations progressed.

In November, the state agency that licenses teachers adopted more stringent standards for training teachers. The Commission on Teacher Credentialing now requires one semester of classroom experience before student teaching; placement in the upper half of the graduating class; "personal fitness," as judged by the university; and increased supervision of student teachers by college officials. The new standards are subject to review by the schools of education in the state university system.

The new deputy superintendent of curriculum, Linda Davis, has directed the decentralization of the district's curriculum and has given more responsibility to principals and teachers. She believes that classroom teachers and principals know best how to upgrade classroom instruction. Principals have been instructed to make daily visits to all classrooms during the 1986-1987 school year, to ascertain whether teachers have adequate resources to educate children. Updated mathematics textbooks and instructional equipment have been purchased and will be distributed to several schools in the district.

C. Development of the Collaborative

Since its establishment almost two years ago, the San Francisco Mathematics Collaborative has redefined, expanded, and formalized its governing structure. The San Francisco Education Fund remains the collaborative's funding agent and the overall clearing house for activities, under the direction of Gladys Thacher. She and Andrew Bundy, Director of Development for the SFEF, oversee and administer the collaborative.

The proposal for refunding, submitted in May, 1986, reflected a reorganization of collaborative management. The responsibilities of project director, were redistributed across two positions--a teacher coordinator and a Director of Development and Community Outreach. In August, 1986, the project director, Theresa Hernandez-Heinz, resigned, and in September, Wandaline Perelli was hired as the teacher coordinator. A mathematics teacher in San Francisco since 1961, Ms. Perelli has a 60 percent appointment with the collaborative. In October, 1986, Janice Toohey, a former social worker now specializing in public relations and fund raising, was appointed on a half-time basis as the Director of Development and Community Outreach. Her major responsibilities include fund raising, establishing contacts with business and industry, and informing the public about collaborative activities. Joanne Pamperin, a secondary mathematics teacher who holds a Masters degree in science and business, is the on-site observer.

Ms. Perelli's office, which is provided by the school district, is located in Parkside, an old school building that houses the district's curriculum director and K through 8 mathematics supervisor. The district is in the process of hiring a secondary mathematics supervisor. Part-time clerical help was to be available through funds provided by the district and the Education Fund, although this has not yet occurred.

The primary policy-making body of the collaborative is the Steering Committee. Committee membership has fluctuated since its conception, but has now stabilized to include the executive director of the Education Fund and representatives from the Exploratorium, San Francisco State University, the University of San Francisco, San Francisco Community College, San Francisco Unified School District, and the private sector. In addition, several members of the collaborative's Teachers' Council sit on the Steering Committee, along with the collaborative's teacher coordinator and the director of development and community outreach. The Steering Committee, which meets monthly, develops and implements policy, monitors and evaluates activities, provides support and guidance to the directors, and participates in the design of future activities. An administrative team comprised of the executive director, teacher coordinator, development director, and the chair of the Steering Committee will be formed and will meet on a regular basis.

A newly formed Advisory Committee facilitates a more formal relationship between the collaborative and the San Francisco Consortium of Higher Education. The Training Council of the Consortium, known as the Tripartite Council, represents the business community, higher education, and the public schools, and includes representatives from the Chamber of Commerce and the San Francisco Education Fund. This Tripartite Council, plus representatives from the Exploratorium, form the Advisory Committee, whose members provide the collaborative with their expertise and perspective.

The Teachers' Council currently is being reconstituted as a subcommittee of the Steering Committee. It will include six teachers and the teacher coordinator, who will be an exofficio member. The council will provide immediate teacher feedback and input regarding collaborative programs and goals. Initially, this committee included five participants from the first Exploratorium Institute, each from a different high school. The restructured committee will include Theresa Hernandez-Heinz, the previous project director. Ms. Hernandez-Heinz' role as one of the six teacher representatives on the council will provide continuity to the project.

D. Relationship with Other Local Initiatives

The Education Fund has created a San Francisco Science Collaborative under a grant from the Carnegie Foundation. The new science collaborative, like the mathematics collaborative, has on staff a half-time director of development responsible for raising funds. The directors of development for the two collaboratives work as a team with the development director for the Education Fund.

The Industry Initiatives for Science and Math Education (IISME) program, coordinated by the Lawrence Hall of Science, familiarizes teachers with science, math, and engineering jobs, and stimulates them to encourage students to pursue math and science careers. The program, now in its second year, was initiated by Bay Area companies to help address an urgent need to enhance and increase the science and mathematics education available to high school students. The program involves 50 to 100 companies and nearly 200 Bay Area teachers.

A new program of the San Francisco Unified School District matches mentor teachers with "new" teachers. "New" teachers are long-term substitutes who have been granted probationary status; in June, 1986, the Board of Education approved nearly 200 such appointments. Mentor teachers receive an additional $4,000 per year and, in return, are expected to make presentations on teaching methods they have found effective, to be available for individual consultations with new teachers, and to make some classroom visits.

E. Project Activities

During 1986, the San Francisco Mathematics Collaborative sponsored a variety of activities which enabled teachers to form networks with their peers and with other professionals, and to increase their awareness of the developing world of mathematics and its applications. A number of activities sponsored by the San Francisco Unified School District or by other Bay Area institutions also offered significant opportunities to area mathematics teachers.

ACTIVITIES SPONSORED BY THE SAN FRANCISCO MATHEMATICS COLLABORATIVE

Exploratorium Follow-Up Sessions for the 1985 Summer Institute

As an integral part of the 1985 Summer Institute held at the Exploratorium, participants attended follow-up sessions during the 1985-1986 school year to pursue in greater depth topics introduced during the summer. These meetings also allowed teachers to share classroom materials related to, and stemming from, their experiences at the Summer Institute. Enthusiasm for these follow-up sessions has been high, with a consistent core of fifteen teachers attending each session. Upon completing all six sessions, each participant received a $250 stipend and $100 for classroom materials.

Three of the follow-up sessions were held in fall, 1985, and three in spring, 1986. Workshop topics included concrete examples of trigonometry, empirical data and power functions, harmonic oscillators, and basic probability concepts. For example, one session featured a presentation by Tom Humphrey, an instructor at the Summer Institute; participants included fourteen San Francisco teachers who had attended the Institute and four Los Angeles collaborative members seeking information about the Exploratorium Summer Institutes. A wide variety of topics were discussed, and a tour of Exploratorium exhibits was provided. Tom Humphrey indicated that the Exploratorium was eager that mathematics teachers return during the summer of 1986 to provide input into how the Exploratorium can best be used by teachers.

1986 Summer Institute

During the summer of 1986, the collaborative offered the second Summer Institute at the Exploratorium, providing stipends amounting to $1,000 per participant. The Institute consisted of two four-week sessions, June 23 through July 22, and July 28 through August 22. Twelve teachers were to attend each session; six who had participated in the 1985 Summer Institute and six who had not. The intent of this mix was to help reinforce information presented, to encourage peer coaching, and to expand the network established at the previous Summer Institute. Nine returning teachers and thirteen new teachers actually attended. Teachers who attended either or both of the Summer Institutes were considered by the collaborative to be "core" teachers.

The 1986 Summer Institute focused on physics and on the underlying mathematics of the Exploratorium exhibits. The program was designed to provide teachers with a personal learning experience in physics, mathematics, and human perception, using classroom discussions and exhibit exploration. Time also was provided for participant interaction.

An interactive mode of instruction was used by the Exploratorium staff to more effectively communicate ideas and to provide teachers an example of teaching interactively. This approach benefitted both the Exploratorium and the teachers; in response to teachers' comments, changes were made in some exhibits to better demonstrate applications of mathematics. In recognition of this contribution, the Exploratorium offered to underwrite the stipends of the twelve returning teachers.

Asked whether the Summer Institute was worthwhile, one teacher commented, "To say 'yes' would be an understatement," and went on to expound on the "great, inspired teaching." Another teacher commented that the experience at the Exploratorium "made me feel more comfortable about being 'looser' in my class. I always had my class more tightly structured. It gave me a freedom and a confidence I didn't have before." A third teacher commented, "At the Exploratorium we were treated as first class citizens. We didn't have a report or a final exam, we just came here and learned." Some teachers suggested that the Institute would be of greater value to teachers who actually taught Physics, and others suggested minor organizational changes, but teacher comments generally were very positive.

Six follow-up sessions to the 1986 Summer Institute will be held during the 1986-1987 school year. One session met during the fall; the others will be held during second semester.

Dinner Lectures

A series of dinner lectures was initiated in 1985 and continued through the 1986-1987 school year. Many of the lectures featured Nobel Laureates and were sponsored by the Chevron Corporation. The events' major goal was to promote collegial relationships among mathematics teachers and representatives from business and industry. The presentations were designed to help teachers bridge the gap between theory and its application in the worlds of commerce, industry, and technology. As a result of these meetings, a sense of collegiality has developed among the mathematics, science, and economic teachers in attendance. The collaborative is attempting to increase participation among representatives from business and industry as a means of promoting their interaction with teachers.

Since the dinner lectures emphasize mathematics as it models the real world and applies to other disciplines, a science teacher from each major high school was invited to attend the dinner lectures in hopes that this would trigger communication and exchange among teachers from these closely aligned fields.

The first dinner lecture of 1986 was held January 23 and featured a seminar entitled "The World Energy Outlook," offered by Chevron U.S.A. Fifty mathematics teachers attended, including fifteen core teachers (teachers who had participated in a Summer Institute), as well as four Chevron representatives and three representatives from the Steering Committee and/or the school district. Ratings of the event ranged from good to excellent (nearly all 4s and 5s on a 5-point scale). Participants cited many positive features of the activity, including the good overview of the world-energy outlook, the references to ways to improve high school education, the chance to talk with other teachers, the audience involvement, the good facilities, and the good food. Suggested improvements included varying and improving the slide presentation and other visual aids; increasing the focus on mathematics and, specifically, on those mathematics concepts that should be emphasized at the high school level; and changing the date or format of the activity.

The second dinner lecture, held February 27, featured Dr. Marian Cleeves Diamond of UC-Berkeley, who spoke on "Environmental Influences on Brain Structure: Implications for Teaching and Learning." Information about the collaborative and its functions was distributed to all participants. Forty-three teachers attended, including ten core teachers, along with six industrial and business representatives and five representatives from the Steering Committee an/or School District. Overall ratings of the event ranged from good to excellent (mostly 5s on a 5-point scale). Positive comments included: "This was a superb lecture. Before deciding to attend, I had not known what to expect. I found Dr. Diamond's presentation easy to follow and to understand. I'm very fascinated by the results she has arrived at and I think I'll do some reading on my own"; "I found the lecture informative and interesting. The food was good and the evening was well planned and organized. I found making new acquaintances among district mathematics teachers and meeting old friends especially gratifying"; "Very good atmosphere and a good group of people. This kind of program helps improve one's self image"; "The most positive feature of the evening was the opportunity to talk with fellow district teachers in a formal dinner setting."

The third dinner lecture, part of Chevron's "Nobel Laureate Series," was held March 12 and featured Nobel Laureate Dr. Emile Segre, who spoke on the antiproton and antimatter. The lecture was fairly general and was designed to provide teachers with a topic for discussion in mathematics classes. Forty-five secondary mathematics teachers attended, including eleven core teachers, seven industry participants, and four representatives from the Steering Committee and/or school district. Overall ratings of the evening were "excellent," (mostly 4s and 5s on a 5-point scale). Positive comments included: "Speaking on a very complex and esoteric subject, Dr. Segre made the topic clear and alive"; "An antiparticles pioneer whose curriculum vita includes the Nobel Prize speaking before a group of nonspecialist secondary teachers--Wow"; "It was wonderful to hear such a brilliant person speak. He made every attempt to make his material understandable for the physics layman. It is good to share some of his information with my class"; "The experience of bringing together the personalities of a Nobel Laureate, Chevron executives, and fellow teachers was memorable. I hope this program continues." Suggestions for change included allowing more time for the main speaker, rather than for comments or panelists, and relating topics more directly to mathematics.

The fourth dinner lecture, featuring Nobel Laureate Dr. Glenn Seaborg, was held June 9. Dr. Seaborg's presentation centered on the development of the periodic table of the elements, the transuranium elements, and predictions on the discovery of "new" transuranium elements. In addition to Dr. Seaborg's presentation, Bob Daniels, President of Chevron Resources, spoke on Chevron's role in supplying nuclear fuel. Teachers seemed reluctant to respond positively toward nuclear development, and some expressed their students' concerns over nuclear power. Approximately thirty people attended. Overall, the teachers, and particularly the science teachers, seemed very pleased with the event.

The fifth dinner lecture, held September 25, featured Nobel Laureate Dr. Kenneth J. Arrow, who discussed "Individual and Social Change." Approximately fifty teachers attended, as well as several Chevron executives. The lecture focused on Dr. Arrow's model of peoples' patterns of choice as displayed in preferences, voting, and expenditures. Some teachers seemed unprepared for the degree of detail and specificity presented in the lecture. One teacher reported appreciating the "opportunity for intellectual stimulation" and the chance to "share thoughts with renowned academicians."

A sixth dinner lecture, featuring Nobel Laureate Paul Berg, was held October 8. Dr. Berg discussed "Genetic Engineering's Roots," with a focus on demystifying the subject of genetic engineering in light of extensive negative median on the subject. Approximately forty-five people attended. Many teachers who attended felt it was one of the most successful and well received of the Nobel Laureate dinners. The audience was very interested in the presentation and asked many questions. One teacher commented, "It proved beyond a doubt that genetics is a science and a worthwhile science that can greatly benefit human kind." Others commented, "I learned a lot about factors leading up to various diseases and what scientists are trying to do to prevent their occurrences," and "[It was] challenging and yet not above the general knowledge of the audience."

On November 12, the dinner lecture featured Nobel Laureate Arthur Schawlow of Stanford University, who spoke on "Lasers and Their Uses." The event, held at San Francisco State University, included complimentary cocktails and dinner and was hosted by Chevron U.S.A. About eighty-five people attended. Dr. Schawlow's presentation was highly descriptive and very clear; he provided many examples, including shooting laser beams across the room. Participants agreed that it was a delightful evening.

Another lecture, also part of the Chevron Dinner Lecture Series, was held November 20 at the McLaren Building on the University of San Francisco campus. The collaborative, the San Francisco Mathematics Teachers Association, and the San Francisco Math Leadership Project cosponsored the event. Dale Seymour, a former mathematics teacher who currently owns a publishing company specializing in supplementary mathematics programs, spoke on "Visual Thinking." He also discussed developing students' conceptual skills through classroom mathematics activities and presented information regarding national scales of student performance in such areas as estimating fractions and percentages. More than 200 elementary, middle and high school mathematics teachers attended. The on-site observer felt the presentation was very well received by the teachers, although the use of non-textbook-based lesson plans may meet with resistance in schools. One teacher commented that "as teachers keyed to a textbook, we often forget the broader areas of teaching how to think and how to learn."

In general, teachers have found the dinner lectures worthwhile, particularly as they provided an opportunity to socialize and to meet with other mathematics teachers. One teacher commented: "The best part is talking with other teachers. Last year was my first year in the public schools. The collaborative has exposed me to nearly sixty other teachers at the monthly dinners. Before, I saw only one or two other teachers. It is a wonderful opportunity that I didn't have before." Another teacher commented that it was "nice to brush with great minds." A third teacher stated that "this sort of evening not only stimulates and broadens the teacher's background of knowledge, but also enlarges his attitudes towards teaching." Another teacher noted: "This project should be continued. I find it very informative and refreshing. It adds something to the positive image of teachers in this district. So seldom are we appreciated." Science teachers have expressed gratitude for being included in the dinner lecture series. One teacher expressed concern that computer science teachers not be overlooked when extending future invitations.

Mini-Grant Program

In the fall of 1986, the Education Fund issued a request to all mathematics teachers to submit proposals. Grants total $1,000 for one teacher, or $2,000 for proposals submitted jointly by two teachers; General Electric provided $11,000 specifically to be granted to mathematics teachers. Teachers were asked to design a project or to request materials that would enrich their students' mathematics education. The projects' primary goals were to enrich mathematics instruction in the public schools, to evaluate the success of each specific project funded by the Mini-Grant Program, and to disseminate information on each project to other teachers who may be interested in duplicating the project or using it as a basis for their own projects. The grants could be used to purchase classroom supplies or audio-visual materials, or to cover other project expenses. Interested teachers were required to submit an application describing the project, its objectives and rationale, its target population, and its budget requirements. Grant recipients also were required to submit evaluations once their projects had been completed.

In order to help teachers make more effective use of the grant offer, the collaborative sponsored proposal-writing workshops for mathematics teachers on October 2 and October 8, 1986. Mathematics teachers were encouraged to attend in a letter from the collaborative's teacher coordinator, Wandaline Perelli.

By the closing date, only three teachers had submitted proposals. Many of those who did not apply maintained that they did not have sufficient time to write a proposal. A second RFP was issued. Ms. Perelli sent another letter, this time inviting all mathematics teachers to a proposal-writing session at her home on Saturday, November 1. As a result of the letter and Ms. Perelli's personal contacts, all twelve teachers who attended submitted a proposal. On November 16, the Appropriation Committee of the Education Fund met to decide which of the twenty proposals that had been submitted would be funded.

For most teachers, this was the first time they had ever prepared a grant proposal. The proposals submitted included requests for funds for: after-school field trips for a mathematics club; partitions and tables for three work stations in a mathematics lab; robotics kids to enable vocational shop students to integrate their work with mathematics; art supplies to help students experience esthetic mathematics development; a field trip to the Exploratorium; a newsletter for teachers at six high schools and refreshments when these teachers met; computer software related to mathematics; books for a resource library; an Exploratorium field trip to work with students on specific exhibits (proposed by a Summer Institute teacher); before-school time for a teacher to train students to be peer tutors; two college students to tutor students during mathematics class; and a computer for a mathematics classroom.

The Appropriations Committee deliberated on the merit of each proposal. Those that were approved were considered to be well planned, to have the potential of impacting a number of students, and to have a clearly specified budget. For some proposals, the funding decision was delayed until more information could be obtained.

Twenty proposals were submitted by mathematics teachers; twelve teachers from eight high schools received grants ranging from $250 to $1,000. The grants will be used to develop a network among mathematics teachers at "small necessary high schools"; computer software; an Exploratorium field trip; materials such as books, calculators, and supplies; peer-tutor training; a Hero 2000 Robotics kit; art supplies; and equipment for a mathematics lab.

Computer Graphics Lab Tour

In January, 1986, a tour of the Graphics Laboratory at the Medical Center at UCSF was offered; twelve teachers took advantage of the opportunity. In addition, Dr. Robert Landeridge gave a dinner lecture on computer design.

ACTIVITIES SPONSORED BY OTHER BAY AREA INSTITUTIONS

Woodrow Wilson Foundation Statistics Workshop

The Woodrow Wilson Foundation sponsored a workshop on statistics and probability on August 4 through August 9 at the Parkside Center. The collaborative promoted the activity, to which all mathematics teachers in the district were invited. Twenty-four teachers attended, including several middle school teachers. The activity's purpose was to promote classroom activities which focus on probability and statistics and to establish a broader picture of mathematics.

IISME Summer Internships

On June 27, 1986, an initial meeting was held for all teachers (called Teacher Fellows) and industry mentors participating in the IISME Summer Internship Program. Approximately eighty-five teachers and eighty-five mentors from thirty-four companies attended. The meeting was designed to acquaint new teachers and mentors with the program and to discuss program objectives, expectations, and guidelines. Teachers and mentors were encouraged to meet weekly to discuss the industrial work experience and ways in which students' study of mathematics and science can be affected as a result of that experience. Teachers were encouraged to keep careful daily records of instructional concepts or ideas which might be useful in teaching and to collect tangible work-related materials. Small group discussions were held to generate recommendations for mentors, teachers, and company coordinators, and to discuss teacher expectations for classroom transfer of the IISME experience. Participants received a summary of these discussions, including concrete suggestions about the qualifications of mathematics teachers for tasks in industry; about inviting mentors to visit classes; about communicating what students are expected to know when they apply for a job in industry; and about studying the problem of changed teaching assignments. One mentor new to the program stated that mentors from the 1985 program told him to "expect the teachers to really work."

A midsummer working meeting was held July 16, and a "wrap-up" meeting was held August 10. Approximately 100 teachers attended the midsummer meeting which brought together the year's IISME Teaching Fellows to discuss their experiences, and to brainstorm about potential means for transferring those experiences back into the classroom. Nobel Laureate Dr. Glenn Seaborg, Director of the Lawrence Hall of Science, was scheduled to speak but was ill. The work of the Lawrence Hall of Science was highlighted in a film and explained by by IISME Director Jane Bowyer. During the afternoon, Dr. Robert Knott, a former high school teacher and current Lawrence Hall of Science employee, gave a brief speech. He stressed that discovery is essential to learning. A question-and-answer session, a general IISME evaluation, and a tour of the Lawrence Hall of Science concluded the meeting.

Participants' comments suggest that they were very pleased with the event and thoroughly enjoyed talking about their industry experiences with the other Teacher Fellows. Their single disappointment was that Dr. Glenn Seaborg was unable to attend.

On October 25, the IISME Teacher Fellows and Industry Mentors who participated in the partnership program met to share experiences. Forty teachers and four representatives from industry attended. Participants suggested that future meetings be scheduled during the week to allow more industry mentors to attend. Teachers said the meeting was useful in that it provided continuity to the IISME experience between summers of employment, and enabled them to exchange information about their experiences, but that low participation was a weakness. They suggested that the IISME Academy be used to promote summer employment for teachers and to disseminate IISME information. At the event, teachers received modems so they could communicate with one another through personal computers; most teachers seemed very excited about the possibility of being part of an electronic billboard.

BEST COPY AVAILABLE

Newsletters

While the San Francisco Mathematics Collaborative does not publish its own newsletter, Theresa Hernandez-Heinz, the project director until August, 1986, wrote a column entitled "Collaborative Corner" for the *Exponent*, the newsletter of the San Francisco Mathematics Teachers Association. In addition, the Exploratorium's *Wavelength*, a newsletter of the Exploratorium Teacher Institute, publicizes collaborative activities.

OTHER ACTIVITIES

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy

Patricia Holleran, a teacher at Galileo High School, attended a six-day conference, "Technology in the Mathematics Classroom", in Exeter, New Hampshire, in June, 1986. The conference emphasized the impact and application of the computer in the curriculum. Participants received hands-on experience with computer software. Ms. Holleran's expenses to attend the conference were paid by the Technical Assistance Project at the Education Development Center.

F. Observations

The San Francisco Mathematics Collaborative progressed in several areas in 1986. Discussion of the collaborative's growth will focus on four major issues: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

During the 1985-1986 school year, the management of the collaborative struggled to define the roles and responsibilities of the project director and the Education Fund. The primary issue involved authority and decision making as they related to collaborative management and activities. Theresa Hernandez-Heinz, as project coordinator, was responsible for organizing collaborative activities and helping the Education Fund raise money. By the end of the school year, a decision had been made to redistribute her responsibilities across two positions--one which would coordinate teacher activities and one which would raise funds and foster a link with the community. Ms. Hernandez-Heinz resigned in August, 1986, and was succeeded by Wandaline Perelli, who was appointed teacher coordinator in September, 1986, and by Janice Toohey, who was appointed Director of Development and Community

Outreach in October, 1986. The smooth transition in the collaborative's management and the continued involvement of Ms. Hernandez-Heinz indicates stability in the collaborative's overall structure.

In order for project management to operate smoothly, several administrative details must be resolved. These include providing the teacher coordinator with clerical help and computer access, with a clear definition of her responsibilities, and with a regular communication link with others involved in administrating the collaborative.

Methods of communication within the collaborative's administrative team and between the collaborative's teacher coordinator and the teachers remain in a formative stage. Ms. Perelli communicates with teachers by mail, through personal contact, and at dinner lectures. Mailings are time consuming, since clerical help is unavailable. The collaborative has been effective in reaching those teachers who regularly attend the dinner lectures, a total of about one-third of all the mathematics teachers. Whether information is reaching the remaining two-thirds is less evident. The collaborative plans to publish a newsletter to help reach these teachers.

The collaborative's administrative team will meet at regular intervals in order to ensure that team members are apprised of all collaborative activities. Regular meetings are of particular importance because team members work in different parts of the city.

The overall organization of the collaborative has been refined. An Advisory Board has been established, the Teacher's Council has been reconstituted, and a Director of Development and Community Outreach has been hired. Teachers representing a variety of schools now serve on the council. These changes, as well as the formation of an Advisory Board that includes business and industry representatives, have the potential of strengthening the link between the collaborative and the teaching and professional communities.

The Education Fund envisions that the collaborative will become institutionalized in the district, so that it will continue long after current funding by the Ford Foundation has been terminated. Refining the roles of the Steering Committee and the Teachers' Council, forming an Advisory Committee, and hiring a Director of Development and Community Outreach, have helped to ensure that the collaborative will become an integral part of the district.

There currently are approximately fifty to sixty teachers who participate in collaborative activities. A strategy to increase the number of participants would be beneficial; the plan to disseminate information through department heads, as noted in the second proposal, takes a step toward the development of such a strategy.

COLLABORATION

The San Francisco Mathematics Collaborative is an activity oriented project that builds on strong local resources. Collaboration is viewed as the building of a strong link between the community and its teachers. In building this link, the San Francisco Mathematics Collaborative has provided teachers with out-of-school professional activities designed to increase teachers' knowledge of mathematics applications, to create a feeling of self-importance in participants, and to establish teachers as experts. A conscious effort has been made through the collaborative to translate out-of-school activities such as institutes, seminars, and workshops into classroom activities. Collaborative activities have allowed mathematics teachers to meet, to exchange information, and to begin networking.

The San Francisco Unified School District is very supportive of the collaborative. Collaborative goals coincide with the direction in which the superintendent would like to lead the district. The arrival of a new superintendent and the establishment of new initiatives within the district, have provided the collaborative an opportunity to have real impact and to build on these initiatives.

The Steering Committee and other committees of the Education fund provide an opportunity for the collaborative's director to interact with representatives of business, industry, and higher education. Janice Toohey, Director of Development and Community Outreach, is actively involved in establishing links between the collaborative and businesses. Her work will help ensure that a strong communication channel is maintained with the business community.

TEACHER PROFESSIONALISM

While the original proposal for funding envisioned structuring the collaborative through the formation of "school site teams" which would be "catalysts for change" within the schools, the present structure is more activity-based and involves those teachers who are most interested in events away from school. This has allowed teachers from different schools to communicate with one other, but it is questionable whether a concentration of actively-involved teachers at each school who can act as "catalysts for change" has actually developed. As the proposal for refunding notes, the collaborative "has been most successful in establishing collegiality and networking among teachers" and has made marked progress in the development of teachers as educational leaders.

In response to direct intervention by the collaborative, mathematics teachers submitted proposals for mini-grants for the first time. Not all of the teachers were successful in their first attempts at proposal writing. In some cases, the form of the proposal, rather than the merit of the proposal itself, caused the committee to decide against funding it. The collaborative has already begun to help teachers develop the skills necessary to write successful grant proposals. Of the twenty proposals submitted by mathematics teachers in November, 1986, twelve were funded.

The Summer Institutes at the Exploratorium, which were originally planned to help teachers, resulted in a mutually beneficial relationship that may have heightened teachers feelings of professionalism. Input on exhibits from teachers in the Summer Institute was well received by the Exploratorium staff and was incorporated in developing mathematical exhibits. It appears that participation in the Summer Institute provided teachers with more than the opportunity to expand their knowledge base and their instructional skills; the experience offered teachers the opportunity to be treated as experts who have something valuable to offer.

MATHEMATICS FOCUS

It is difficult to document instructional changes, the inclusion of new mathematical topics and applications in classes, and increased student knowledge of how mathematics is being used in the world of work. There is evidence, however, that collaborative efforts may lead to such changes. The comments of teachers who attended the dinner lectures indicate that they acquired deeper understanding of mathematics applications. The mini-grant proposals, which included requests to have students study exhibits at the Exploratorium from a mathematical perspective, indicate that a new resource was discovered through an activity sponsored by the collaborative.

G. Next Steps

The San Francisco Mathematics Collaborative will continue to pursue the original three goals of nurturing professional development, building collegiality and networks among teachers and other mathematics professionals, and infusing "real world" applications of mathematics into instruction.

In achieving these goals, the collaborative will develop leadership skills of teachers and department heads; keep teachers informed of new developments, changes, and research in mathematics, mathematics education and cognitive sciences; have teachers serve as mentors to their peers; include mathematics professionals in activities; encourage exchange of information among teachers and other professionals; use the involvement with the Exploratorium as a model for collaborating with other institutes; and encourage experimentation and creativity in instruction.

The collaborative will continue to take advantage of Chevron USA's Nobel Dinner Lecture Series and to support corporate and industrial tours which are to be facilitated by business representatives who have participated in the Discrete Mathematics Seminars.

New activities that are planned for the 1986-1987 school year (in addition to the current activities) include monthly seminars on discrete mathematics conducted by staff from universities in the area, a two week mathematics leadership institute that will address problem areas of providing leadership for the area of mathematics within a school setting to be held in the summer of 1987, and monthly follow-up sessions to the leadership institute during the academic year. Other activities will be planned that will relate to local events or initiatives such as the celebration of the 50th year since the opening of the Golden Gate Bridge.

The collaborative will actively pursue positioning itself so that it becomes an integral part of the community that will have a lasting presence and influence over the quality of mathematics education in the public schools. The new director of development and community outreach will aggressively seek funds from both businesses and foundations so that there are the additional resources needed for the collaborative to continue and to implement its ambitious program. She will also seek additional visibility and support from the community for its activities.

SUMMARY REPORT:
TWIN CITIES URBAN MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the 1986 activities of the Twin Cities Urban Mathematics Collaborative. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long term-goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Twin Cities Mathematics Urban Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco of representatives of all of the projects; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

TWIN CITIES URBAN MATHEMATICS COLLABORATIVE

A. Purpose

The purpose of the Twin Cities Urban Mathematics Collaborative, as expressed in the original proposal, is "to extend the sense of professionalism among secondary school mathematics teachers, provide for their further intellectual stimulation and renewal, and establish collegial and professional relationships among the teacher and the wider mathematical community of the Twin Cities." During the first year of funding, the collaborative worked towards these goals. In the second year of funding and in subsequent years, the collaborative's efforts will be directed at refining the focus of the original goals. This includes addressing issues which deal with more sophisticated areas of intellectual and political involvement, extending the involvement throughout the Twin Cities, and seeking avenues to ensure continuation of the collaborative project beyond the involvement of the Ford Foundation. Five specific steps have been identified to help the collaborative achieve its goals. They are:

1. involving teachers in activities that help them to exercise more responsibility and control over their professional lives;
2. continuing to provide a broad range of mathematical activities that encourage ongoing participation within the collaborative;
3. expanding the base and scope of industrial involvement;
4. integrating groups and organizations involved in precollege mathematics education into the collaborative; and
5. increasing the visibility and the stature of the collaborative in the Twin Cities, specifically within the school districts.

B. Context

The State of Minnesota is experiencing extreme economic difficulties. In 1986, the state faced a $734 million dollar shortfall, and a farm economy crisis has seen the value of farm land drop from $1,000 per acre in 1978 to $290 per acre in 1986. These and other economic problems have prompted the state to lower its financing of education from nearly three-quarters of the total expense to less than one-third of the cost. In 1987, basic state aid will total $1,700 per pupil unit. The reduced state funds have placed more of the financial burden of education onto the districts. The financial problems of Minneapolis and St. Paul are compounded due to the decline in the earnings of local industry, particularly in some of the high technology industries. While local school boards do retain some capacity for increasing property taxes, the maximum levy is limited by law.

In spite of the declining economy, "excellence in education" was a campaign cry of the current governor. He proposed several reforms for Minnesota schools, including an open enrollment policy, which would allow students to attend high schools anywhere in the state rather than limiting students to their own districts. This cross-over proposal failed to find support in the Legislature, which then passed its own proposal, the Post-Secondary Enrollment Options Act (PSOEA). PSOEA allowed any eleventh or twelfth grader enrolled in a public high school in Minnesota to attend any college (public or private), part-time or full-time, at no cost, and to receive both high school and college credit for courses taken. Costs are paid by diverting district funds to the colleges. The bill was amended in 1986 to grant high school credit only for college courses taken at district expense. If a student wishes to receive college credit, the student normally will not receive high school credit and must pay college tuition. While the amended bill helps to reduce the financial impact on school districts, the PSOEA program still causes state funds to be diverted from school districts to colleges. This program, as well as the expiration of an early teacher retirement program in 1986, have placed added financial pressures on Minnesota's school districts.

The political environment for the state changed as a result of the last election. The Democrats gained the majority in the Legislature. The state now has a Democratic governor, Senate and House.

The two school districts which comprise the Twin Cities Urban Mathematics Collaborative, Minneapolis and St. Paul, are similar in some regards and quite different in others. Minneapolis has seven senior high schools (grades 9 through 12) and six junior high schools (grades 7 through 8). St. Paul has six senior high schools (grades 10 through 12) and eight junior high schools (grades 7 through 9). In both districts, department chairs are selected by the teachers and can be changed annually. The department chairs determine class schedules and offerings but have little additional power. The two districts combined employ fewer than a dozen minority mathematics teachers.

St. Paul has struggled to maintain quality public education, competing with a very strong parochial school system which has, in the past, enrolled a large proportion of the district's students, thereby reducing support in the city for public education. Even though the overall student population is declining, the minority population is increasing. Under the leadership of Superintendent, David Bennett, who has held the position for one year, the St. Paul schools have begun the process of desegregation by instituting some elementary magnet programs. The high cost of the desegregation program, including the busing of students, that was introduced in 1985-1986 appears to have been a contributing factor to the financial problems of St. Paul.

Court-ordered desegregation in Minneapolis was in effect from 1973 to 1981. In 1981, the district approved a five-year plan proposed by then-newly appointed Superintendent Dr. Richard Green. This plan resulted in the closing of eighteen schools and the desegregation of all schools in the Minneapolis school district. The minority population at any one school in a given grade must fall within 15 percent of the average number of minority students enrolled in that grade in the district as a whole.

St. Paul and Minneapolis have been experienced a large influx of Southeast Asian immigrants, as well as an increase in other minority groups. In addition, Minneapolis may be facing the flight of middle-class homeowners from the city during the next four years. Results of a recent survey, to which 82 percent of the city's 79,000 homeowners responded, indicated that 17 percent plan to move out of the city by 1991. Increasing concern regarding neighborhood security was the most frequent reason given for their plans to leave.

The St. Paul and Minneapolis school districts each have responded differently to graduation requirements. St. Paul follows the state requirement of one year of mathematics or one year of science in grades 10 through 12; Minneapolis has increased this requirement to one year of mathematics and one year of science. Minneapolis also has instituted a standard minimum curriculum which is supported by "benchmark" tests that are used to identify students for intervention classes. The University of Minnesota is considering requiring three years of secondary school mathematics for admission; if this is adopted, it may influence the graduation requirements of both school districts. While the framework exists for a strong state role, it should be noted that effective power in schooling still resides at the local level.

Another impact of the five-year plan adopted by the Minneapolis school district has been the reassignment of teachers. Supported by the teachers' union, teachers filled the reduced number of positions by seniority. This resulted in some of the senior high school teachers, even those having as many as fourteen years of experience, being reassigned to junior high schools. The addition of the mathematics requirement, combined with the decision in Minneapolis to staff for a six- (rather than five-) hour day in grades 9 through 12, has resulted in the hiring of some new teachers in each high school.

The reassignment and nonrenewal of teachers could continue to be a problem in the future. There currently is a trend toward decreasing student enrollment in both the Minneapolis and the St. Paul school districts at the secondary levels, and increasing student enrollment at the primary levels. The decline in the number of secondary students is expected to reach its nadir at 3000 below current levels by 1990. Declining enrollments have particularly affected St. Paul. While the district has assured teachers that they will have jobs, it is also telling them they will probably not have a choice of assignment. A positive note is that it is anticipated that the predicted teacher shortage within the next five to ten years may be offset by the abolition of the mandatory retirement rules.

Each of the mathematics supervisors in the two districts has had health problems that affected his level of activity within the district. The Minneapolis mathematics consultant, Ross Taylor, is currently on leave and is expected to take a sabbatical leave during the winter semester of 1987. He has been very supportive of the collaborative, and has regularly held both meetings of his department chairs and inservices for teachers to which the collaborative's on-site observer has been invited. Minneapolis currently is selecting new mathematics textbooks as part of its six-year textbook cycle, and a book by Taylor is under consideration. Charles Lund, the assistant director for mathematics, science, and computer technology for the St. Paul schools, has returned to his position from an extended leave of absence in fall, 1986, and is becoming more supportive of collaborative activities. Inservices for mathematics teachers in St. Paul are less frequent than in Minneapolis.

A State Task Force of the Higher Education Coordinating Board (HECB) has recommended the adoption of a set of skills desired for college work. One of its recommendations is that a statewide test in mathematics be instituted for high schools juniors in order to appraise students of their strengths and weaknesses. Consideration is being given to basing the new test on the ATOMS (Advanced Testing of Mathematical Skills) Exam, which was developed at the University of Minnesota. The collaborative is considering ways to become involved in the continued development of this examination.

C. Development of the Collaborative

During 1986, the Twin Cities Urban Mathematics collaborative was administrated by Harvey Keynes, the project director. Dr. Keynes is a professor and director of special projects for the School of Mathematics of the University of Minnesota. Dr. Christopher Ennis, a lecturer and former assistant to the director of the School of Mathematics, was the project coordinator until fall, 1986, when he resigned to take a position at Carleton College in Northfield. A search to fill the position of project coordinator is being conducted. It is anticipated that the position will be filled before the end of the 1986-1987 school year.

It is also anticipated that the new project coordinator will relieve the project director of the need to spend so much time on fundraising; during the 1985-1986 school year, three months of the director's time was spent raising funds.

In December, 1986, Sally Sloan, a teacher at Edison High School in Minneapolis, agreed to be the collaborative's teacher coordinator and newsletter co-editor. The on-site observer for the collaborative project is Gerry Sell, a parent and a former teacher who has been very active in the public schools for a number of years, including as a candidate for the School Board. Ms. Sell also co-edits the collaborative newsletter and serves as project historian.

The Steering Committee, which oversees the activities of the collaborative, was increased by three teachers in 1986, bringing the total membership to fifteen. The committee is now comprised of five teachers, the mathematics supervisor from each of the two districts, four representatives from local industries, one from the Science Museum of Minnesota, and three representatives from area universities and colleges. The project director also serves on the Steering Committee. The number of teachers on the Steering Committee was increased from two to five in order to give teachers more influence. This coincides with the director's initiative to have teachers assume a larger role in the leadership of the collaborative. One member of the original committee was replaced by Kenneth Vos, a mathematics education professor from St. Catherine's College, St. Paul. Professor Vos, along with Wayne Roberts of the mathematics department of Macalester College, will help strengthen the relationship between the collaborative and small colleges. Both of these individuals are well known to the teachers in the area, and their membership on the Steering Committee reinforces the impression that the collaborative does not belong solely to the University of Minnesota.

The Steering Committee met three times during the 1985-1986 school year--twice independently and once in conjunction with the Teacher Advisory Committee. A meeting of the Steering Committee, scheduled for January, 1986, was cancelled because too few members were able to attend. Subcommittees of the Steering Committee include: the Industrial Collaboration Committee, which is responsible for investigating links with industry; the Professionalization Subcommittee, which is charged with identifying activities and procedures to address the issue of teacher professionalism; and the Funding and Support Committee, which determines various forms of financial and non-financial support for current and future activities of the collaborative.

During the 1985-1986 school year, the Steering Committee was relatively passive, with Harvey Keynes and Chris Ennis effectively making policy and implementing activities. In lieu of the January meeting, a memo was sent to Steering Committee members soliciting their input on sources of support; a proposal for the collaborative to "buy" slots for teachers in the NSF Renewal Project in summer, 1986; and the 1986 Summer Institute focusing on problem solving and enrichment for the junior high/middle school curriculum. At the committee's March meeting, support was expressed for the Summer Institute for junior high teachers and for funding four or five positions at the NSF Renewal Project. The collaborative newsletter also was discussed. The major issue at the meeting, however, was the Phase II funding proposal to the Ford Foundation. A modification of the collaborative to involve the Alliance for Science was proposed; the Steering Committee did not support this. Only the teachers on the Steering Committee were able to attend the May 13 meeting. Its main purpose was to discuss the funding proposal that was to be submitted on May 15.

During 1986, the Steering Committee began to take a greater interest in the decision-making process. At the November, 1986, meeting, at which eight of the Steering Committee members were present, the issues of governance and leadership were raised. A teacher commented, "Wasn't that a surprise? I was all ready to drop and now it looks like the whole governance business is wide open. I think I'll stay." The meeting was considered to be successful in generating new ideas for the collaborative.

A Teacher Advisory Committee was formed in fall, 1985, and was composed of five teachers, all of whom had participated in the 1985 Summer Institute. The Teacher Advisory Committee is the link between teachers, and the director and coordinator of the collaborative. Two members of the Teacher Advisory Committee also serve on the Steering Committee. The Teacher Advisory Committee advises the Steering Committee and is viewed as an advocate for teachers' ideas. The committee plans to meet following each Steering Committee meeting.

The first meeting of the Teacher Advisory Committee was held in October 1985. The agenda included discussion of the collaborative newsletter, a mini-grant program, and a series of academic-year seminars. At this meeting, the teachers expressed a concern that the application form for the 1985 Summer Institute was intimidating, and recommended that the form be revised for the 1986 Institute.

The second meeting of the Teacher Advisory Committee was held, at the request of the teachers, on February 10, 1986, one half hour prior to a Twin Cities Precollege Math Society Dinner Meeting. The meeting's agenda was left open, and teachers were advised that any issues or topics could be addressed or discussed. The two main topics discussed were the possibility of offering a Summer Institute for junior high and middle school teachers, and the possibility of supporting a few teachers to participate in the NSF Teacher Renewal Project. Both items were unanimously approved. Secondary teachers are very interested in programs on teaching at the junior high and middle school level, since they are certified for grades 7 through 12, and some of them are being transferred to classes in the lower grades.

On May 13, a joint meeting of the Steering Committee and the Teacher Advisory Committee was held. Only three teachers, the director, and the coordinator of the collaborative attended.

In fall, 1986, the five teachers on the Teacher Advisory Committee were asked whether they wished to continue their involvement on the committee. Two teachers who resigned because of other commitments were replaced by two junior high teachers who had attended the 1986 Summer Institute and who had expressed interest in serving on the committee. The teacher coordinator, Sally Sloan, also was added to the committee; its membership for the 1986-1987 school year totals six. The TAC's main purpose is to implement programs already approved in principle by the Steering Committee. The two teachers who sit on the TAC and the Steering Committee serve as the liaisons between the two. If the TAC proposes a program, the idea must go to the Steering Committee for approval. Because the functions of the two committees were clarified and the composition of the TAC changed in 1986-1987, the TAC is accepting more responsibility.

The collaborative newsletter (which is described in detail under the "Activities" section of this paper) is a primary channel of communication between the collaborative and the teachers. The collaborative offered a $1,000 honorarium to a teacher who would serve as co-editor of the paper with Ms. Sells. This position was advertised in fall, 1986, and filled in December, 1986, with the appointment of Sally Sloan as teacher coordinator. It is anticipated that she also will facilitate teacher-directed projects. Both the Minneapolis and the St. Paul school districts were reluctant to facilitate release of a teacher to undertake the task. This reluctance is consistent with their policies that discourage assumption of a commitment initially funded from an external source. However, it should be noted that both districts have committed some financial support to the collaborative and to teacher release time.

Collaborative funding in 1986-1987 required a 25 percent match from local sources. The collaborative chose to divide the required $15,000 equally among three major groups of sponsoring organizations: universities/colleges, school districts, and private corporations. In the spring of 1986, a campaign was conducted to solicit the necessary funds from each of the three groups. The School of Mathematics at the University of Minnesota immediately committed $4,800 in federal funds. This, along with $1,000 from Macalester College, comprised the allocation from the university/college sector. On March 15, 1986, a presentation was made by the project director to the Minnesota High Technology Council Educational Subcommittee to explain the collaborative, its activities, and its need for funds. The education subcommittee conducted a fundraising campaign among its members, resulting in a combined pledge of $5,100 from five private corporations. Garnering financial support from the two school districts required the most effort and time. After extensive discussions about the collaborative's achievements and goals with district personnel and

School Board members, each district agreed to provide $3,000 for 1986-1987. Each school district also agreed to provide 32.8 teacher release days during the year. In addition to the funds solicited from the three groups of sponsoring organizations, it is estimated that $300 will be raised from the $2 registration fee teachers pay to attend collaborative-sponsored dinners.

The collaborative monitors its activities through surveys, questionnaires, and the Teacher Advisory Council. Information is collected from participants at collaborative activities, as well as through the newsletter. Teachers have been polled on such diverse issues as whether to offer a problem-solving Summer Institute that emphasizes junior high, and whether a small registration fee at dinner meetings would substantially effect attendance. Ongoing polling of teachers on important activities will continue as a means of maintaining teacher input into shaping the collaborative's direction.

D. Relationship with Other Local Initiatives

Because of its close association with the university, the collaborative draws upon a wide variety of mathematical resources. In addition to its collaborative work, the School of Mathematics is involved with the Talented Youth Mathematics Project, the Actuarial Science Program, the NSF Teacher Renewal project, and the Minnesota Mathematics Mobilization (M^3). The university also provides the collaborative with a link to the national mathematical community and gives the collaborative access to visiting scholars such as Uri Treisman, from the University of California-Berkeley, who consulted for the 1985 Summer' Institute.

The School of Mathematics programs most related to collaborative efforts are the NSF Teacher Renewal project and the Minnesota Mathematics Mobilization (M^3). Initiated in the summer of 1986, the NSF Teacher Renewal project, under the directorship of Harvey Keynes, sponsors a Summer Institute on mathematical topics, and follow-up seminars during the academic year for selected Minnesota secondary teachers. This Institute was modeled after the one sponsored by the collaborative during the summer of 1985. Of the 105 teachers in the 1986 NSF Institute, four had participated in the 1985 TCUMC Summer Institute, and thirteen were collaborative members. Participation of five of these was funded by the collaborative. The Institute helped to form a close bond among collaborative members who have attended; since the summer, information has circulated within the group. Seventy-one participants from the NSF Institute attended the first academic-year seminar in November, 1986. Eighty-five attended the second seminar in December, 1986, including those from the collaborative's Summer Institute.

The Minnesota Mathematics Mobilization (M^3) is a new project for Minnesota, and it is intended, in part, to become a state version of the Mathematical Sciences Education Board. The project is funded by a three-year grant from the NSF to the University of Minnesota School of Mathematics and to St. Olaf College in order to provide a means of communication at the state level among educational, industrial and governmental leaders concerning precollege mathematics education. M^3 is intended to nurture projects of common interest to mathematicians, scientists, and mathematics educators; to articulate positions on important issues in a timely manner; and to represent the broad interests of mathematics education at all levels of education, industry, and government. Harvey Keynes and Lynn Arthur Steen of St. Olaf College are co-directors of M^3. Several times a year, M^3 publishes a newsletter, which is distributed to all mathematics teachers in the state, as well as to other mathematical scientists on the mailing list. The project sponsored a conference on May 10, 1986, on the Minnesota Postsecondary Options Enrollment Act (PSOEA); the registration fee for collaborative teachers was waived. A second M^3 conference on November 3, 1986, focused on the changing roles for teachers as encouraged by the Carnegie and Holmes report. In the future, regional centers will be established around the state to encourage local communication among teachers and mathematical scientists.

The Minnesota Council of Teachers of Mathematics is very active. It sponsors fall and spring conferences and publishes its own newsletter. In addition, a mathematics club for teachers from the Twin Cities area provides social opportunities for mathematics teachers.

In St. Paul, a group of junior high teachers requested and received a mini-grant from the district to form mathematics-league teams in the junior highs. The $1,600 grant will be shared among nine schools to pay for transportation, prizes, and teacher time for writing problems. The teachers who applied for this mini-grant had attended the Summer Institute but submitted the proposal on their own. Previously, mathematics leagues existed only at the high school level. The teachers who received the grant got the idea for the junior high teams during the collaborative's Summer Institute. The grant's advisor is a very active high school league teacher who serves on both the Steering and Teacher Advisory committees. Team coaches are volunteering their time.

E. Project Activities

During 1986, the Twin Cities Urban Mathematics Collaborative sponsored a wide variety of activities for mathematics teachers. These included a series of dinner lectures, a seminar series and the 1986 Summer Institute. In addition, the collaborative published its own newsletter, which is an important networking component of the project.

TCPMS Dinner Meetings

When the collaborative was established in 1985, the Twin Cities Pre-College Mathematics Society (TCPMS) was formed to organize functions which would facilitate professional and social contact among mathematics teachers, and university and industrial mathematicians. The society sponsored dinner meetings in March and in May, 1985. The success of these meetings prompted TCPMS to schedule four more during the 1985-1986 school year; they were held in October, December, February and April. Those invited to attend included all secondary mathematics teachers from Minneapolis and St. Paul, including mathematics supervisors and consultants; some faculty from the University of Minnesota, Macalester College and Hamline University; and representatives from industry and business (including Honeywell, 3M, Sperry, Cray, Control Data and several smaller companies). Also invited were representatives from the State Department of Education and from the Governor's office.

The first dinner meeting for the 1985-1986 academic year was hosted on October 9, 1985, by the Science Museum of Minnesota during its "My Daughter the Scientist" exhibition. Susan Friedlander, Professor of Mathematics at the University of Illinois-Chicago, spoke on her work in fluid dynamics. Following her presentation, dinner was served to the seventy people in attendance in the Science Museum's Penthouse Lounge. The project coordinator received many positive comments from participants.

The second dinner meeting was held at Macalester College on December 2. Dr. Daniel Johnson of the Honeywell Systems and Research Center discussed the mathematics behind the Karmarker Algorithm. All collaborative members were invited. Forty-five people attended; the lower attendance was due to a severe snow storm. Participants appreciated Dr. Johnson's speech and expressed their enjoyment at the camaraderie that developed among those who had conquered the weather.

The third dinner meeting, on February 10, 1986, also was held at Macalester College. Dr. William Etter, Associate Director of Basic R&D, Technical Services, General Mills, Inc., discussed the psychological and quantitative aspects of decision-making and the structuring of consumer decision-making as it relates to developing improved products and services. About sixty-five people attended this dinner. The on-site observer reported that the teachers were becoming accustomed to the dinners; they appreciated getting together outside of school and being able to interact with university professors. A survey about the newsletter was distributed to the teachers at this dinner.

The fourth and final dinner meeting for the 1985-1986 school year was held on April 23 at Macalester College. Dr. Joseph Gallian of the Department of Mathematical Sciences at the University of Minnesota, Duluth, spoke on the use of product identification codes. The talk focused on the methods used for assigning identification numbers to passports, books and retail items. More than fifty people attended.

The Twin Cities Precollege Mathematics Society has planned another series of dinner meetings for the 1986-1987 academic year. While the format of the meetings will remain the same, a $2 reservation fee will be instituted to discourage last-minute cancellations. As in the past, there will be no charge for dinner. Topics will focus to a greater degree on teaching, in a conscious attempt to determine whether this will be more appealing to teachers.

The first meeting for the 1986-1987 school year was held October 22, 1986, at Macalester College. Two teachers, Marlys Henke and Terri Lentsch, discussed teaching techniques related to geometry and problem solving; the two took turns playing the role of the student and of teacher. This was the first teacher-directed meeting, and also the first at which the $2 registration fee was charged. The director felt that the forty-five people who attended was a respectable total, and indicated that the fee did not greatly deter attendance.

Results of an evaluation form returned by thirty-three participants indicate that, on a scale of 1 (poor) to 5 (excellent), the presentation was rated 4 (fourteen respondents) or 5 (nineteen respondents), and the entire evening was rated 4 or 5. Eleven of the respondents were newcomers, while twenty-one of the participants who responded to the questionnaire had attended previous dinners. Comments included: "Let's continue to bring in high school teachers as speakers"; "I wouldn't miss these for anything"; "Very good presentation and excellent presenters"; "I am crunched for time. Could I just come for dinner?"

The second dinner meeting was held December 2, 1986. Tom Ressler of the University of Minnesota discussed teaching mathematics to minority students. While the collaborative's director expressed some concern that the topic may not be relevant to all teachers, he felt that it provided a unique dimension and should be tried. About forty people attended. The slightly lower numbers at this dinner prompted the director to consider reevaluating the $2 fee.

Overall, the dinner meetings were a success; teachers' reactions were extremely favorable. After a dinner meeting one teacher said, "Everything was wonderful--just being with fellow mathematicians in a pleasant environment is worth so much. I feel different--it has a psychological effect. Teachers get so few perks, a free dinner with a good speaker just makes you feel good." Other teachers commented: "I can talk to people I never see. I can't tell you how great these have been. I have told every teacher I know who hasn't come"; "Camaraderie is super. I wouldn't mind if there were six meetings instead of four." Another teacher, who said that the activity was "definitely" worthwhile, asked, "Can we find some high school teachers who could give some talks? At least one or two of the speakers should be from our ranks."

Reaction from a representative of a high tech firm was equally positive. "I have met so many teachers and have been able to share my perspectives. . . . I really like being with the teachers." University representatives enjoyed the talks for the most part, but appeared to place less value on the personal contacts that they made.

Academic Year Seminars

In 1985, the collaborative sponsored a very successful three-week Summer Institute on problem solving. As a follow-up, the nineteen participating teachers were invited to continue to meet throughout the academic year to discuss implementation of the classroom projects detailed in the Summer Institute and to work on new modules for classroom use. The first of eight "Academic Year Seminars" was held in November, 1985, and the final seminar met in July, 1986. The meetings generally were held on Thursdays from 2:45-4:45 p.m. Guest speakers were invited to several of the seminars: Mark Driscoll of the Education Development Center spoke January 16, and Dr. Gloria Gilmer, the chairperson of the American Mathematics Society (AMS) Committee on Opportunities in Mathematics for Disadvantaged Groups, addressed the group on April 24. All teachers in the Twin Cities Urban Math Collaborative were invited to hear Dr. Gilmer speak and to attend a reception in her honor.

The February Academic Year Seminar provided an opportunity for in-depth conversation between teachers and university faculty. Following the seminar, participants had dinner at the Campus Club. The conversation continued well after the end of dinner, and no one left until the waiters finally dimmed the lights. It was felt that the February meeting made a good beginning in eroding the feelings of intimidation many teachers appear to experience when they interact with university faculty. Due to the relatively small numbers, people had an opportunity to become acquainted on a personal level.

The last seminar on July 10, featured presentations of the final versions of the classroom modules. Topics included Cubic Equations, Nim, Clock Arithmetic, Motivation of the Transcendental Functions, Recursive Definitions, and a Visual Project.

All ten teachers who attended thought the activity was valuable. One teacher said, "I've got a good unit for my students. [It was] hard work, but worth it." Another said, "After a while I really got hooked on my project." Others observed that their projects were very time consuming, and that they were relieved to be finished. Professor Bert Fristedt, the instructor from the 1985 Summer Institute, attended the July session.

Attendance at all the Academic Year Seminars was quite good. Of the eighteen teachers still teaching in the Twin Cities area, approximately eleven to thirteen attended each seminar. One reason for less-than-perfect attendance at each meeting was that the majority of potential participants also are coaches, and their coaching schedules conflicted with the Thursday afternoon seminars.

1986 Summer Institute

A highlight of 1986 collaborative activities was a Summer Institute offered from 9:00 a.m.-1:00 p.m. daily between June 20 and July 14. The program, which was restricted to collaborative members focused on problem solving and enrichment topics for the junior high curriculum. It was taught by Professor Wayne Roberts of Macalester College. The seventeen participant teachers each received a stipend of $600, and $15 per week for transportation as well as four mathematics credits from the Extension Division of the University of Minnesota. An announcement of the Summer Institute was sent to all collaborative members who responded to a survey distributed through a February 10 mailing and the March newsletter. Twenty-six applications with supporting transcripts and letters of recommendation were received by the April 7 application deadline. Twenty teachers and four alternates were selected. Of these, seventeen actually attended. Seven taught in six Minneapolis schools and seven taught in five St. Paul schools. The group also included two parochial school teachers and one private school teacher.

The daily schedule began at 9:00 a.m. with a problem-solving session at which sample problems and appropriate strategies were discussed. A thirty-minute break followed, and then, frequently, a one-hour lecture by a representative of industry on a topic such as actuarial problems. The hour from noon-1:00 p.m. was spent working in groups solving problems. On occasion, an afternoon session was scheduled for a presentation from such visiting speakers as Tom Romberg, who spoke on mathematical modeling and geometric probability.

Tom Romberg observed that in the morning session he attended all of the teachers were attentive and willing to guess, to propose solutions, and to generalize beyond the facts. The instructor of the workshop, Wayne Roberts, noted that the teachers were overcoming their initial expectations for immediate help or feedback.

The seventeen collaborative members who participated were junior high school teachers. Each was expected to devote a considerable amount of time to solving problems, as well as to developing a problem file to be used with his or her own classes. In addition, fifteen of the teachers developed curriculum modules to be shared with the other participants and to be used as resources for junior high teachers. The authors were to test their modules on students in the fall of 1986. In November, 1986, a one-page summary was prepared by the author(s) and submitted to Harvey Keynes. The summary included the title, the authors' names, a brief description of content, the school level targeted, the audience, and the state of completion of the project. The summaries were sent to all teachers who participated in the collaborative or NSF Summer Institute. Teachers who want a module copy can request one from the authors. The titles of modules prepared by collaborative Institute participants are: Critical Thinking in Mathematics; Discrete Additions to a Pre-Algebra Course; File of Problems for Slow Learners; Integrating Problem Solving into the Classroom; Problem Files (including problems for teaching a unit on problem solving); Problem Solving Using Pascal's Triangle; and Questions About "PI."

It should be noted that the National Science Foundation Teacher Renewal Project ran concurrently on campus with the collaborative Summer Institute. The NSF and UMC participants shared common break times and attended the industrial lectures together. Furthermore, because the collaborative supported five slots in the NSF Project, five additional collaborative members participated in this program. Overall, 105 teachers participated in the NSF Institute, each attending one of five classes oriented towards using problem solving in different content areas.

Reactions to the Summer Institute were extremely positive regarding instructional quality and the Institute's structure and context. Participants also rated favorably their interactions with colleagues. All but one participant reported that their knowledge of mathematics and problem solving had increased because of the Institute, and two people said they intended to enroll in further mathematics courses. One teacher commented, "I feel like a mathematician." Another observed, "For me, it is a rebirth in mathematics, a wanting to study and learn about mathematics and to bring some of this back to the classroom."

While all but one teacher felt that participation in the Institute would affect their teaching attitudes, methods and the style of their classes, the responses were much less positive in terms of whether the participants felt they could be advocates for change. Six people did not foresee any change for at least the next year. Others viewed themselves as advocating a problem-solving approach among their colleagues and indicated that they felt comfortable doing so because of their "increased understanding of problem solving."

Participants also were very strong in their support of the collaborative's effort in aiming a program specifically at the junior high school teacher. Evaluation forms indicated that prior to the Institute many had felt excluded, and that their pertinent problems had been neglected.

One teacher noted, "Remember the junior high teachers when workshops are being planned. Too often the material is geared to senior high teachers who already have more than the junior high teachers to work wit" Another wrote: "It must be stressed to companies, foundations, etc. the need for work at the junior high level. It seems to me more important or at least as important as focusing at the senior high level. This program (UMC) was so valuable."

Participants reported that one of the most important aspects of the Summer Institute was the interaction among teachers. "We need more of this in teaching," commented one participant. Another wrote, "Being with my colleagues was of tremendous benefit."

As in 1985, a series of Academic Year Seminars was planned as a follow-up to the Summer Institute. Meetings were scheduled Monday, November 3; Saturday, December 13; Wednesday, February 25; and Saturday, April 25. At each seminar, individual classes will meet for two hours, followed by a short meeting of all participants. The 1986-1987 Academic Year Seminars are being held in conjunction with the NSF Teacher Renewal Project. The Saturday meetings were scheduled to enable NSF participants from out-of-state to attend some of the sessions. The collaborative participants will join the NSF participants in the general sessions.

All seminars, except the first (at which participants worked on units and modules to be developed during the academic year), will include a lecture. On December 13, 1986, Bert Fristedt spoke on "Aesthetics and Imagination in the Final Stages of Solving a Problem," emphasizing appropriate thinking during the final stages of problem solving or during the stage after the problem has been solved. On February 25, 1987, Professor Phil Wagreich of the University of Illinois-Chicago will speak on a computer-based integrated mathematics, physics, and science program to improve problem solving and quantitative skills in elementary and junior high school. Tom Romberg is scheduled to speak at the April 25, 1987, meeting on the work of the NCTM Standards Committee.

Urban Mathematics Collaborative Newsletter

An important networking component of the Twin Cities Mathematics Collaborative is the "Urban Mathematics Collaborative Newsletter," which was first published in December, 1985. The newsletter is designed to encourage teachers to learn about and discuss issues related to their professional lives. It is sent to approximately 400 people, including all UMC teachers, and several industrial, business, university, college and school administrative personnel. Approximately 225 public secondary mathematics teachers and fifty private and parochial teachers are on the mailing list.

During the 1985-1986 school year, the newsletter was co-edited by Gerry Sell, the collaborative's on-site observer and Eileen Wells, a Minneapolis junior high school mathematics teacher and department chair. Future editions of the newsletter will be co-edited by Gerry Sell and Sally Sloan, the new teacher coordinator.

Five issues of the newsletter were published during the 1985-1986 academic year, and four or five issues are planned for 1986-1987. The newsletters range from two to eight pages and include information on available projects, collaborative activities and individuals, as well as articles by teachers on classroom activities (i.e. NIM), and announcements of upcoming events. The newsletters are mailed to the teachers' home addresses. Forty teachers responded to a questionnaire regarding the newsletter; their overall impression was positive and they indicated that the length was about right, and that the layout was good. The teachers also provided suggestions for article topics, such as teaching methods, math games and puzzles, book reviews, and summaries of collaborative presentations. Some teachers included comments, "I thought it was great! Keep it up." "Please keep this easy to read." "Glad to read the biographies. Like 'teacher tips' idea, but not the one published as an idea." "The Newsletter keeps getting better and better." A university professor noted: "Please give me some extra copies--I have students intending to be secondary teachers. They need to see those problem-solving strategies."

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy

Four teachers from the collaborative received funding to attend the conference on computers in secondary school mathematics in Exeter, New Hampshire, in June, 1986. Judith MacAlpine and Charles Marston were funded through the Technical Assistance Project at the Education Development Corporation; two other area teachers were funded through the Eli Lilly Foundation. The conference focused on the impact and application of the computer on the curriculum. Among topics discussed were discrete mathematics, new developments in mathematics, and issues in mathematics education.

F. Observations

The Twin Cities Urban Mathematics Collaborative progressed in several areas in 1986. Discussion of the collaborative's growth will focus on four major issues: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

A major concern of the collaborative director involves passing more decision-making and organizational responsibility to the teachers. Currently, he feels that he is viewed as the person in control, as the individual to provide the initiative and services. The issue becomes one of structuring a transition in his relationship with the active teachers. In order to do this, the Teacher Advisory Committee must have a stronger sense that it represents a constituency and must be more confident in undertaking organizational responsibilities. The committee is beginning to move in this direction.

Most teachers on the Teacher Advisory Committee have appreciated the experience of working with other teachers and the opportunity to affect collaborative decisions. One teacher felt the committee was primarily involved in reaction, rather than action. Teachers on the committee have expressed the feeling that the May 13 meeting occurred too close to the proposal's submission date for their input to be meaningful. Changes suggested by the teachers included: having more teachers participate; rotating the membership so that more teachers become involved; being notified of a preset agenda well in advance of each meeting; and meeting more frequently at a convenient and regular time, such as prior to the Precollege Mathematics Society dinners. The collaborative has begun to implement many of these suggestions.

COLLABORATION

There is a distinct difference in levels of collaborative involvement between teachers from St. Paul and those from Minneapolis. This may reflect differences in the relationships between the mathematics supervisors and the teachers in the two school districts. The relatively higher participation by St. Paul teachers may reflect a situation in which fewer district activities are provided for them.

One positive contribution of the collaborative's first year has been its success in eradicating stereotypes. Teachers have found that college professors can possess teaching and pedagogical skills, as well as research interests.

With the inclusion of junior high school teachers has come advocacy for program elements directed specifically to them. The diversity of teachers' interests makes it difficult to plan dinner meetings that are relevant to everyone. In order to address this issue, planners have concentrated on the quality of presenters. Also, speakers will be briefed on teachers' expectations for the dinner meetings.

TEACHER PROFESSIONALISM

In the two school districts, contracts are negotiated with attention to teachers' duties and hours of work. The transition from paid effort to a voluntary contribution of time and energy is yet to come for the majority of teachers. Among the teaching population, there is an older group who have been reserved about change and their involvement in it. Characteristically, members of this group who have attended the collaborative dinners have done so without becoming involved in other activities.

A developing area of interest for the collaborative may be its response to issues identified in such documents as the Holmes Report and the Carnegie Forum report. If the thrust of these documents is adopted, lead teachers will be looked to for curriculum development. The implications for redefinition of teachers' work could be reflected in collaborative activities designed to prepare and assist these teachers.

MATHEMATICS FOCUS

The Twin Cities Urban Mathematics Collaborative is oriented towards mathematics and the expansion of teachers' knowledge about mathematics and mathematics education. The central theme of the collaborative has been, and will continue to be, mathematical problem solving in a variety of contexts. This, as well as mathematics applications and important issues and changes occurring in secondary mathematics, will be emphasized in the coming year.

The collaborative leadership views its strength, as reported in its proposal for refunding, as being "in a very strong and perhaps even unique position to provide intellectual leadership and excellent instruction in the area of mathematical problem solving and applications."

G. Next Steps

A primary concern of the collaborative's leadership is the identification of funding sources as the Ford Foundation withdraws its financial support. By August, 1987, the collaborative must find considerably more local money than was committed for 1986-1987: $26,000 to $27,000, compared to $15,000. While some additional funds may be identified, it will be a challenge to identify other funding sources in a manner that will not dilute the energy that is devoted to the substantive content and implementation of the collaborative's endeavors. Professor Keynes feels that, under the existing structure and governance, the intellectual quality of the project is materially undermined by the concern with fundraising.

It is the intention of the director to bring the "hard issues" to the fore at future meetings of the Steering Committee. Furthermore, the role of the Teacher Advisory Committee will be strengthened and its scope of interests will broaden. More of the dinner events and tours will involve teachers as leading speakers and/or organizers.

Dr. Mark Driscoll of the Technical Assistance Project has been asked to make a presentation to the collaborative teachers. Both districts will be asked to provide release time to enable teachers to attend.

Activities over the next two years will resemble those of this year and will include: the Precollege Mathematics Society speaker/dinner programs; Summer Institutes and conferences; Academic Year Seminars on mathematical topics; support of collaborative members to participate in NSF Institutes and other professional conferences; mini-grants; university and public-school co-teaching of calculus; and tours of industries and businesses.

SUMMARY REPORT:
TECHNICAL ASSISTANCE PROJECT

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

December, 1986

PURPOSE OF THIS REPORT

This report summarizes the work of the Technical Assistance Project during 1986. The report is intended to be both factual and interpretive. These interpretations have been made in light of the long term goals of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts.

The information presented in this came from the following sources: the proposal submitted by EDC to the Ford Foundation for the continued funding of the Technical Assistance Project; information provided by the project staff; the meeting in San Francisco of representatives of all of the projects; and several meetings involving the staff of the Documentation Project, the staff of the Technical Assistance Project, and Barbara Nelson of the Ford Foundation.

TECHNICAL ASSISTANCE PROJECT

A. Purpose

The purpose of the Technical Assistance Project (TAP) is to provide a broad range of assistance to the Urban Mathematics Collaborative project in eleven cities. This assistance is provided not only in response to direct requests from the collaboratives, but in response to needs identified by the Technical Assistance Project itself. It is the TAP's responsibility to keep informed of changes in the mathematics teaching profession and to communicate these insights to the collaboratives in ways that are meaningful. It is the Project's goal to help provide a managed program of change, thereby facilitating each collaborative's growth and development in a way that fulfills the collaborative's own objectives. In particular, the Technical Assistance Project was established to:

1. provide the collaboratives with a resource network so that they may access expert information about on-going mathematics activities, national professional organizations, new developments in curriculum, and current trends in issues of equity, industrial uses of mathematics, and teacher isolation;

2. provide opportunities for the members of the collaborative projects to participate in national and regional symposia, workshops, and pilot projects;

3. establish intra-collaborative communication among the eleven collaboratives, using such means as an electronic bulletin board, a regularly published newsletter, and sponsorship of conferences to bring people from each site who hold comparable positions (i.e., school district mathematics supervisors); and

4. provide assistance to the collaboratives in solving local problems and in identifying resources to meet local needs.

As the Urban Mathematics Collaborative (UMC) Project evolves, the Technical Assistance Project will shift its focus to enabling each site to provide its own technical assistance. TAP responsibilities also may include contributing to the development of a series of training workshops designed to help other communities establish collaboratives.

B. Context

The Education Development Center (EDC) has been integrally involved in curriculum development and teacher education since 1967. It has pioneered the use of new technologies as tools for teachers and learners; the establishment of the Technical Assistance Project within EDC recognizes the growing importance of the interaction between technology and education.

The EDC staff includes people with backgrounds in mathematics, mathematics education, cognitive psychology, artificial intelligence, and school and mathematics administration. Several staff have technological backgrounds in electronic communications, computer hardware, and educational software development. A number of the EDC staff also are experienced in the area of teacher training.

Dr. Mark Driscoll, director of the Technical Assistance Project, allocates approximately 75 percent of his time to the TAP. He is assisted by a full-time program assistant, Melissa Fox, and a half-time technical assistant, M. Grace Kelemanik.

The Education Development Center has a long association with Harvard University. It currently has a contract with Harvard's Educational Technology Center to produce computer software for the development of algebraic and geometric concepts.

In addition to the Harvard contract, two other projects funded at EDC are relevant to the objectives of the UMC project. One such project provides technical assistance to the Women's Educational Equity Act project, and another, funded by NSF, is developing instructional materials in mathematics that integrate the use of technology.

During 1985-1986, the staff of the Technical Assistance Project met as needed with other EDC staff to discuss issues and to identify solutions. The TAP thus was able to draw upon the diverse resources of EDC in providing technical assistance to the collaboratives. These meetings with other EDC staff have been scheduled regularly during the 1986-1987 school year.

To support the Technical Assistance Project, EDC has established a Mathematics Advisory Panel composed of approximately twenty distinguished mathematics educators and representatives from major institutions, organizations, and agencies. The Mathematics Advisory Panel has served as an informal source of guidance and as a networking resource for information, contacts and dissemination.

C. Development of the Project

The initial contact between the Urban Mathematics Collaborative project and the Education Development Center occurred in April, 1985. Barbara Scott Nelson, Project Officer of the Ford Foundation, approached EDC as one of the three institutions which had responded to a Ford Foundation request for proposals to provide technical support to the Urban Mathematics Collaborative Project. On September 1, 1985, the Technical Assistance Project was formally established, with Dr. Mark Driscoll as project director.

EDC had originally envisioned its role as one of providing technical assistance to each site through training, materials development, organizational development, dissemination, and information provision; all interaction would be initiated by the sites. In formulating plans for a technical assistance project, however, Barbara Nelson directed EDC to provide interactive assistance rather than to simply react to the discrete needs of individual sites.

As a result, EDC's role in the Urban Mathematics Collaborative project surpasses the traditional approach and involves not only reacting to requests from sites, but also initiating interaction with them. In this broader approach to technical assistance, EDC draws upon its resources and expertise to provide challenges and leadership to the sites. Thus, the Technical Assistance Project is not a passive component waiting to be called upon, but rather is an integral component of the Ford Foundation's overall efforts in the UMC project.

The role of the Technical Assistance Project has evolved as the UMC project has developed. The TAP and the sites have become more interactive as project personnel have increased their understanding of the model of change on which the UMC project effort is based, and of the concept of collaboration which the Ford Foundation is attempting to foster.

D. Relationship with Other Initiatives

The Technical Assistance Project is only one of many EDC projects that impact on mathematics education. Several other EDC projects relate closely to the efforts of the UMC project. EDC has a grant from NSF to define a new approach to mathematics learning and teaching for grades K through 6. Mark Driscoll, the director of the TAP, is the co-principal investigator of the grant. Through this participation, Dr. Driscoll meets periodically with directors of the seven other NSF grants. This provides him an opportunity to receive input from other projects actively engaged in reforming curriculum in grades K through 12 and to relay this information to the Urban Mathematics Collaborative sites.

In the summer of 1986, the Ford Foundation provided a grant to EDC (in addition to its funding of the UMC project) to develop materials for use by teachers in urban centers to motivate students at risk in mathematics. A. Alif Muhammad, a black mathematics teacher at the Cambridge Ridge and Latin School in Cambridge, Massachusetts, was hired as an EDC project associate. Mr. Muhammad took a leave of absence for the first semester of the 1986-1987 school year to develop a training program designed to enhance self-esteem in inner-city mathematics students. The program emphasizes methods of stimulating students to value acquisition of academic knowledge and skills, not only as "tickets" to extrinsic rewards, but for self-actualization and improvement in personal competence and quality of life. The program includes demonstrations of exemplary supplementary curriculum materials, as well as observation and discussion of various approaches to pedagogy. Teaching methods are demonstrated in videotape presentations. Mr. Muhammad interviewed educators in several urban areas in researching approaches to pedagogy for his training program. The Technical Assistance Project has access to these materials and plans to use Mr. Muhammad as a resource should the need arise in any of the eleven collaborative sites.

Dr. Driscoll also is working to establish links between national organizations and the UMC project. He has met with staff of the Society for Industry and Applied Mathematics (SIAM), who expressed interest in including an article on the UMC project in the society's newsletter. In July, the director of the Twin Cities Collaborative was introduced at the annual meeting of the Society for Industry and Applied Mathematics in Boston. Mark Driscoll and Ross Finney, senior consultant for the Technical Assistance Project, also attended. At the meeting, ways in which SIAM could take an active interest in the UMC project were explored. The Resource Panel formed by EDC for the Technical Assistance Project also provides important links to other organizations.

E. Project Activities

Visits to Collaborative Sites

When the Technical Assistance Project was first established, Mark Driscoll felt it was very important to visit each site in order to establish personal contact and to communicate the nature of the Technical Assistance Project; he visited each of the seven collaboratives during the 1985-1986 school year. The visits to each site, however, proved to be multi-purposeful. In Cleveland, Dr. Driscoll accompanied teachers on a tour of a local NASA facility. In San Francisco, he visited the Exploratorium to talk with teachers in the San Francisco Collaborative's Teacher Advisory Group about what they thought EDC could provide them. In April, Dr. Driscoll attended a joint meeting of the Los Angeles and San Francisco collaboratives.

Because these visits proved so beneficial for both the Technical Assistance Project and the individual collaborative sites, Dr. Driscoll plans to make annual site visits. In November, 1986, he began the second cycle of such visits.

Information Services to Sites

The Technical Assistance Project has used its capability as a clearinghouse to disseminate information to the collaborative sites on such topics as major initiatives for the support of mathematics education, new curricular developments, and opportunities for teachers to participate in regional and national events. It has also responded to specific requests for information from collaborative projects, as well as referred collaboratives to sources of information for their own follow-up.

The Technical Assistance Project has also assisted the collaboratives in identifying human resources. For example, Mark Driscoll's suggestion to the coordinator of the Los Angeles Collaborative prompted the involvement of Bill Lucas, Professor of Mathematics at Claremont Graduate School, in the collaborative. Dr. Lucas serves on the collaborative's Advisory Committee and presented a four-session workshop on discrete mathematics as part of a workshop series organized and sponsored by the Los Angeles Collaborative.

Telephone Hotline

In September, 1985, the Technical Assistance Project established a toll-free telephone number to allow the collaboratives to contact the project without concern about cost.

Common Ground Computer Network

On October 1, the Technical Assistance Project initiated an electronic communication system to link together all collaborative sites, as well as the Teacher Assistance Project, the Documentation Project and the Ford Foundation. The network, called Common Ground, is an electronic mail-and-message system developed especially for teachers by the Educational Technology Center at Harvard. The network is experiencing some start-up problems, some of which can be attributed to incompatible hardware and telephone systems, and others due to the fact that Common Ground is new and is being used in a long-distance application for the first time. These problems are being overcome, however, and there is increasing usage of the system. As of December 1, eight of the eleven collaborative sites, and both the Technical Assistance Project and the Documentation Project, were participating in the network.

While the usage level varies significantly between sites, most communications are between sites and EDC, or between the Documentation Project and sites.

Annual Meeting of Collaborative Project Staffs

One of the Technical Assistance Project's responsibilities involves coordination of an annual conference for all the staff of the Urban Mathematics Collaborative project. The first such meeting was held in Cleveland in 1985; the second meeting was held October 15 through 18, 1986, in San Francisco. Fifty-two people attended, including the director, coordinator and on-site observer from each site, four members of the Documentation Project, four representatives from EDC, four representatives from the Ford Foundation, and one person from the Carnegie Corporation. The activities of each site, including the Documentation Project and the Technical Assistance Project, were discussed at general sessions. Participants also attended small-group sessions to discuss issues relevant to their specific roles in the collaboratives. Extra curricular activities included a visit to the San Francisco Exploratorium, dinner at a Chinese restaurant, and dinner at the St. Francis Yacht Club.

The overall rating of the meeting, based on responses from twenty-four participants who returned evaluations, averaged between "very good" and "good." Nearly all of the respondents either agreed or strongly agreed that the objectives for the meeting were clearly stated and satisfactorily accomplished, that the material was useful and stimulated thought, that they were able to exchange experiences, and that the meeting helped them to think about alternative strategies and approaches. The most beneficial aspect of the meeting, as reported by the participants, was the opportunity to interact with each other and to get to know what was happening at the other sites. The interaction among people from the different collaboratives has changed the approach taken by some sites. For example, after the meeting, one collaborative reconsidered the importance of the teacher involvement and restructured its advisory committee to include more teachers. This collaborative also decided to increase personal contact with teachers by visiting each school several times.

Funding of Teacher Participation in Outside Projects

During 1986, the Technical Assistance Project funded teachers in several collaboratives to meet with each other and to attend national conferences. These teachers have very much appreciated the opportunity to meet with their peers from other cities and to participate as a group in important national, professional conferences.

During summer, 1986, the Technical Assistance Project funded fifteen teachers, representing five of the seven collaboratives, to attend a summer workshop on computers in schools at the Phillips Exeter Academy in Exeter, New Hampshire. Individual collaboratives sponsored additional teachers to attend this conference. As a follow-up to this meeting, the Technical Assistance Project offered to fund Los Angeles teachers to visit San Diego to meet with teachers from the San Diego collaborative. They have not yet taken advantage of this offer.

On November 22, the Technical Assistance Project funded one teacher from Pittsburgh to attend a users' conference on the UCSMP curriculum. This teacher will accompany the district's Mathematics Consultant, Dr. Diane Briars.

The Technical Assistant Project assisted in funding two teachers from the Los Angeles collaborative to spend a week in November working in several high schools in the Boston area. These schools are using the Geometric Supposer, which was developed at EDC, in conjunction with Harvard's Educational Technology Center. In addition to becoming familiar with the software, the teachers visited an exemplary resource center to review other geometry software and meet with staff. It is expected that these teachers, along with those who attend other EDC sponsored activities, will make presentations to teachers from the UMC collaboratives at the 1987 NCTM meeting in Anaheim, in April, 1987.

As part of its efforts to facilitate direct communication among collaboratives, the TAP funded a group of teachers from the Los Angeles collaborative to visit the Exploratorium in San Francisco, and to meet with teachers from the San Francisco collaborative. This visit, which occurred in April, motivated the Los Angeles teachers to try to establish an institution like the Exploratorium in their own area.

Newsletter

In March, 1986, the Technical Assistance Project published the first issue of a collaborative newsletter, UMC Angles. The newsletter will be published four times annually and will be distributed to collaborative staff as well as to representatives of national organizations. The newsletter was published three times in 1986; editions included articles on the University of Chicago School Mathematics Project; the International Society of Mathematics Conference held at the University of California at Berkeley, written by James Gleick; book reviews; and reviews of instructional programs and materials. The newsletter will raise issues and direct awareness to concerns relevant to the development of the UMC initiative as a whole.

Meeting of Mathematics Supervisors

In December, the Technical Assistant Project organized a meeting for the school district mathematics supervisors in the cities where collaboratives are located. Supervisors from all of the cities except Cleveland attended, as did Tom Romberg, Director of the Documentation Project.

The meeting began Sunday evening with an informal Chinese dinner. No program was scheduled so that the participants would have an opportunity to unwind from their travels and get to know one another. The formal meeting began at 9 a.m. December 15. Mark Driscoll explained the Technical Assistance Project, and Tom Romberg briefly described the Ford Foundation's UMC project and the Documentation Project's role in it. Each of the supervisors was then asked to comment on the problems, activities, and perspectives in each district. It was interesting to note that the problems identified by the supervisors related to students and not to teachers. They included low pupil achievement, low minority participation in advanced courses, and the pressures of increased requirements for students.

During the afternoon, EDC staff made two presentations. The first was a videotape which had just been completed on multiple representations of mathematical concepts. It was an excellent tape and was well received by the supervisors; they all wanted (and received) a copy for their districts' use. In addition, Project Assistant Alif Muhammed discussed motivational activities designed to enhance students' self-esteem. This presentation also was well received, as it addressed a student problem common to all sites. The supervisors requested a copy of the written report, which is soon to be completed.

The remainder of the day was spent discussing a series of questions prepared by Mark Driscoll which addressed the issues of teacher isolation, motivating teacher to take advantage of professional opportunities, increased requirements for mathematics, drop-outs, technology, underrepresentation of minority students in mathematics, teachers not fully qualified to teach mathematics, and evaluation. The participants felt that an additional question related to changing teachers' and parents' low expectations of students should be added. It was agreed that each question should be addressed in each site and then discussed in detail at a later date. In fact all the supervisors felt that meeting together was important, and that future meetings were warranted.

F. Observations

As discussed, the term "technical assistance", as applied to this project, is broadly defined. Initial expectations of the services to be provided by the Technical Assistance Project varied by collaborative. This variance was reflected in the differential levels of use of TAP resources. In practice, the Technical Assistance Project plays a dual role. In one light, it can be viewed as both a means of identifying outside resources and as a resource in itself, providing information and funding. In another light, it is a mechanism for the establishment of a communication network between UMC sites. The role of the Technical Assistance Project is evolving in conjunction with the entire UMC project; in this sense, it can be viewed as another site in the total UMC enterprise. How TAP functions, and the role it establishes, will provide a model for other sites engaged in collaborative formation.

This year has seen the development of a strong relationship among the Technical Assistance Project, the Documentation Project, and the Ford Foundation. Regular meetings of the three now provide a forum for discussion of issues, of long-term objectives, and of strategy. The tripartite meetings provide a structured environment for identifying problems, as well as suggesting initiatives directed toward particular sites. TAP is now being viewed as an agent for assisting individual sites to succeed. It is responsible for relaying suggestions made in the tripartite meetings to the sites and it is the conduit through which supportive action is channeled on all issues identified at the meetings, except for administrative concerns that are best handled by the Ford Foundation.

While the tripartite meetings are a positive step, a more systematic exchange of information between the TAP and the Documentation Project, particularly with respect to pre-visitation preparation, would be desirable. Perhaps Common Ground will help to facilitate this type of communication.

The introduction of the Common Ground system has, in general, been well received. Two sites, plus the Documentation Project, are frequent users. These two collaborative sites, however, use the network primarily to communicate with the TAP, rather than with each other. As of December, 1986, three collaboratives and the Ford Foundation had yet to join the system. The TAP may have been overly optimistic in its expectation of rapid and widespread participation. In hindsight, the project did not prepare for the induction process as fully as was warranted.

It is hoped that the success of the meetings of mathematics supervisors will lead to similar meetings of other key figures at various sites. Meetings might be held for members of the Council of the Great City Schools (the superintendents of thirty of the largest urban school districts) and other district superintendents.

G. Next Steps

The project is progressing in its development of a notion of interactive technical assistance. The "critical friend" role played by the Documentation Project is now complemented by interactive support from the Technical Assistance Project.

The sites are progressing through stages of evolution in their requests for technical assistance. Gauging the development of each site and making judgments about appropriate levels of personalized, probing and intervening assistance is a challenge for EDC. While TAP must continue to educate the sites on the services it can provide, it also must help sites to plan for the time when they must provide their own technical assistance.

During the coming year, several themes will underly the focus of the "food for thought" which the TAP disseminates to the collaboratives. These include identifying ideas for motivating borderline mathematics students at the junior high and early high school levels, and finding materials related to mathematics as it is used in the real worlds of business and industry. Attention also will be directed to the issue of fundraising and to deeper involvement with university and industrial mathematical scientists.

In the near future, the TAP will plan a dissemination program for which EDC will receive separate funding. It is anticipated that, although the new initiative would be an activity district from the current Technical Assistance Project, the two efforts would interact. The dissemination program will direct its attention to helping sites in three ways. First, it will help participants in the collaborative to enunciate curriculum changes that are affecting them or that they are initiating. This help will be provided in the form of written materials and consultation. Second, help will be provided to the sites by defining outcomes of their projects that will have bearing on fundraising. The third means of assistance will be in the area of long-range planning.